MODERN
REFRIGERATION
AND AIR CONTROL

Vol. 63 No. 752 NOVEMBER, 1960 Price 2s. 6d. monthly

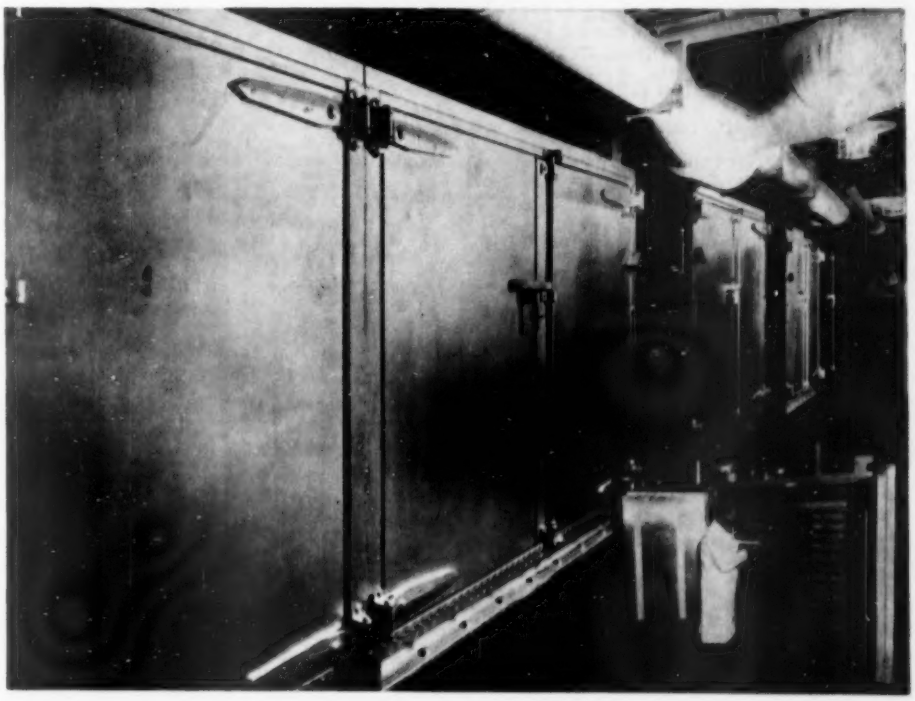
MODERN FREEZING – FAST

More and more attention is being given to the problems of freezing fish at sea on the fishing grounds. Jackstone Froster Limited have done a great deal of research into this problem over the last ten years or more and their wide experience is available regarding the installation of freezing equipment on trawlers and factory ships.

A battery of five multiplate freezing cabinets were installed by Messrs. Chr. Salvesen & Co., Leith, on factory ships "FAIRTRY II" and "FAIRTRY III". On each vessel the equipment is calculated to give a throughput of 27 tons filleted fish per day. Jackstone multiplate cabinets have doors at front and back to facilitate through loading and easy maintenance and cleaning.

★ ★ ★ ★ ★ ★ ★ ★

Full details of all Jackstone Models for freezing AT SEA or ON LAND are available on request.

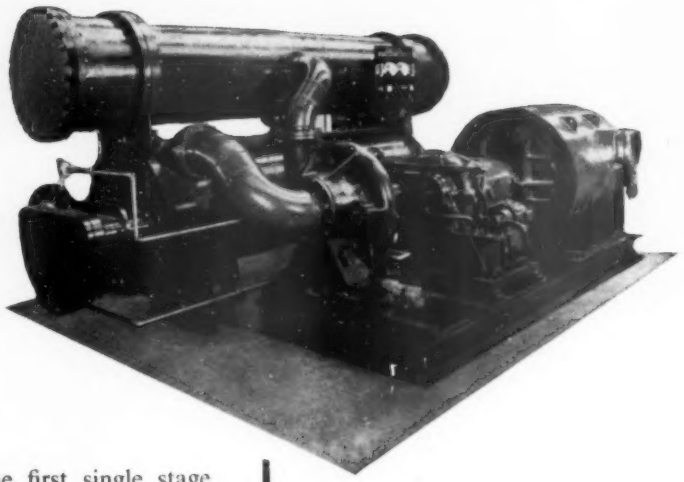


Jackstone Froster Ltd.

HUMBER BRIDGE ROAD · GRIMSBY · ENGLAND

TURBO SET FOR AHMADI HOSPITAL KUWAIT—

and another first for YORK



What are believed to be the first single stage turbo compressor water chilling systems to be exported from Great Britain to the Middle East left recently for Kuwait Oil Company's new hospital.

Two entirely self-contained turbo packaged water cooling systems were designed, with special consideration given to the problems arising from insufficient fresh water supplies and the necessity of using sea water for cooling. Each system is rated to cool 875 gallons per minute, which represents a heat removal rate of 4.2 million B.Th.U's per hour.

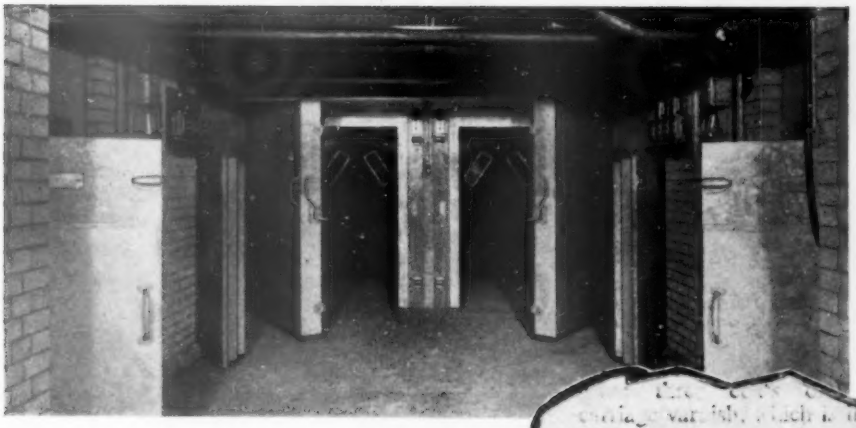
Consulting Architects and Engineers:—
HUCKLE & DURKIN,
London

Main contractors:—
BRIGHTSIDE HEATING & ENGINEERING CO. LTD.,
London

YORK SHIPLEY LIMITED

A Member of the Borg-Warner International Group

North Circular Road, London, N.W.2.



The hinges and fasteners are of the most up-to-date type, and the principle on which these doors are hung is a " finger touch " shutting and opening

they used

CASSEY

ROL-CAS

and

SUPER-CAS

fittings

—of course!

our new address :—

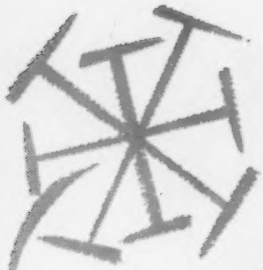
141 PLECK ROAD,

WALSALL, STAFFS.

Telephone : WALSALL 25438

The offices of Walter Cassey Limited, together with their well-known range of Refrigerator and Cold Storage fittings will in future be situated at the above address.
This concentration of our efforts will ensure you a fast, streamlined service.

WALTER CASSEY LIMITED



3 *aids to efficient operation of coldrooms...by the coldroom problem specialists!*

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AIR CURTAINS FOR OPEN COLDROOM DOORS

- COMPLETELY UNIMPEDED DOORWAYS!
- MAINTAINING TEMPERATURES!
- EASY MOVEMENT OF GOODS!

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PART HEIGHT FLEXIBLE CLOSURES FOR CHILLROOM DOORWAYS

- EXCELLENT VISIBILITY!
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DEHYDRATION FOR PERMANENTLY DRY INSULATION

- MAINTAINS FULL INSULATION EFFICIENCY!
- ELIMINATES RE-INSULATION COSTS!
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Lec WINS THE SPACE RACE

with the

model S.18

18 cu. ft. Commercial refrigerator

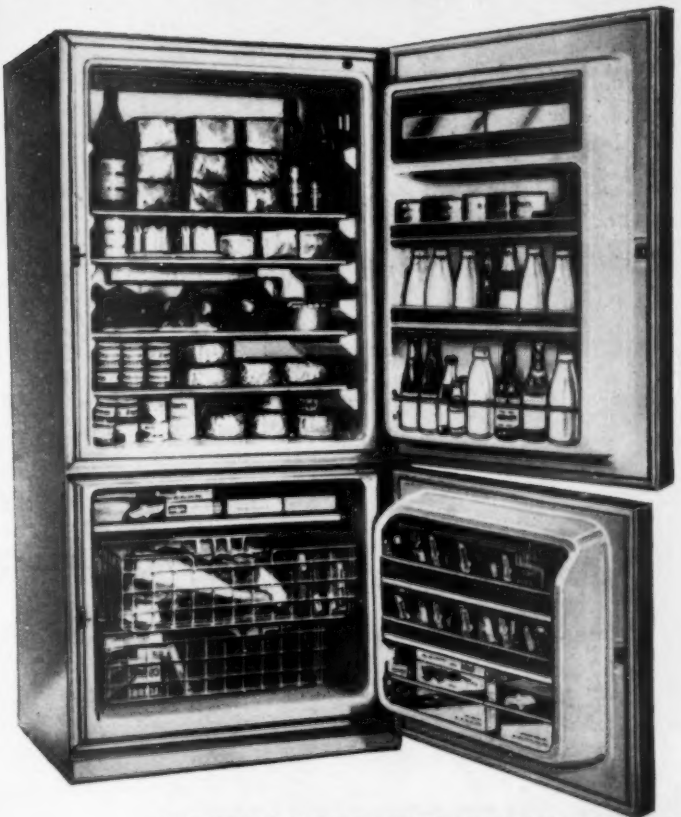
This handsome giant is an outstanding new advance in refrigeration, giving 12·1 cu. ft. of normal refrigeration and 6 cu. ft. of deep freeze in a single unit of superb design and faultless manufacture.

DIMENSIONS:

Height 74", Width 34", Depth 30"
(approx. only)

Price **£179 10. 0.**

including 12 months' service fee of £10.



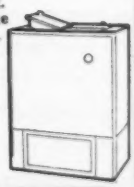
SPECIAL FEATURES OF THE LEC S.18

Tall Bottle Area
Sliding Shelves
Butter & Cheese Compartments
Adjustable Aluminium Door Racks
Trimline Styling
Sliding Frozen Storage Baskets
Freezer Door Shelves

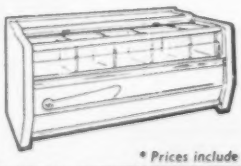
Other models from the great LEC range

HF 4
Upright Freezer. Capacity: 4 cu. ft. Height: 44" Length: 23¾" Width: 23" Price: £71.0.0.*

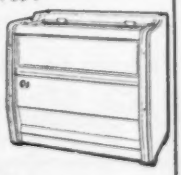
C 9
Conservator. Capacity 3 cu. ft. Holds 15 gals. ice cream or 120 lb. frozen food. Price: £74.0.0.*



GS 91
Super Salesman. Capacity: 11.4 cu. ft. Height: 42¾". Length: 72". Width: 30". Price: £230.10.0.*



GSD 71
Junior Salesman. Capacity: 7.1 cu. ft. Height: 42¾". Length: 46". Width: 30". Price: £149.10.0.*



** Prices include 12 months' service fee*

It's the newest achievement by Lec

Full range of products can be seen at our London Showrooms :
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POST THIS COUPON TODAY !

To : Lec REFRIGERATION LTD.,
BOGNOR REGIS, SUSSEX

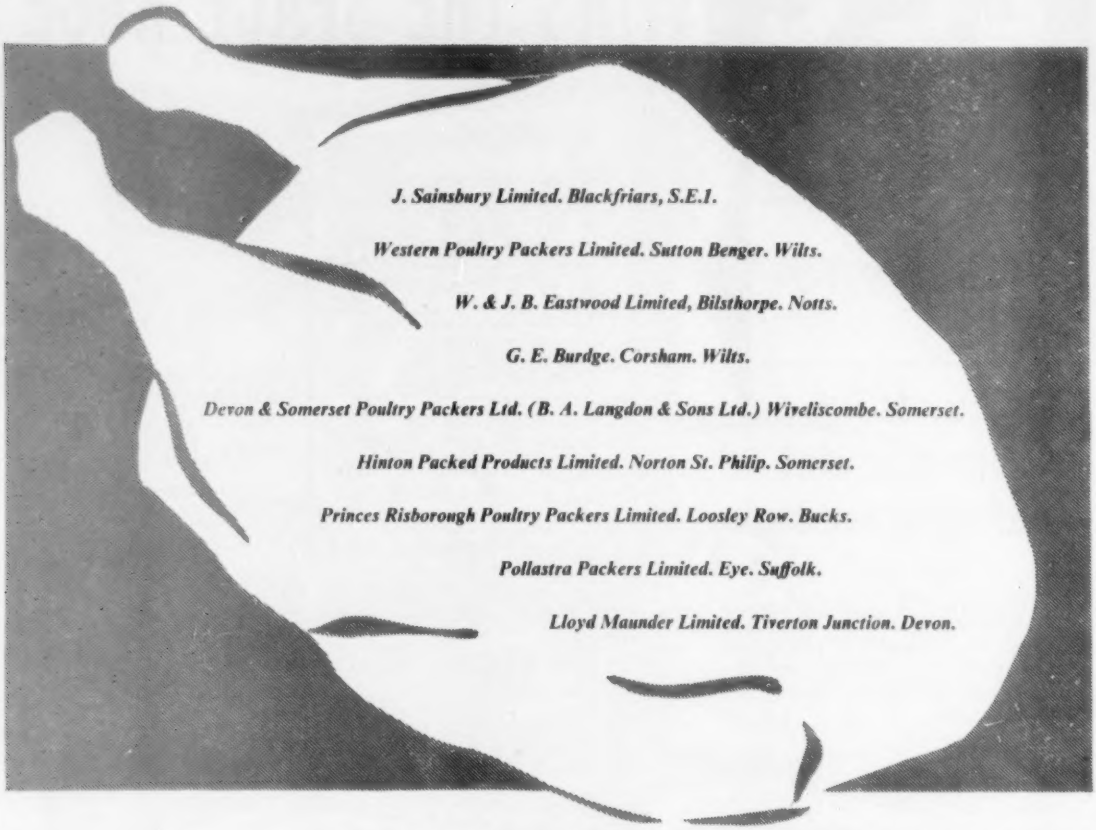
Please send me full details of the Lec S.18 and other commercial cabinets.

NAME.....

ADDRESS.....

.....MR25

THESE LEADING BROILER PROCESSORS


J. Sainsbury Limited. Blackfriars, S.E.1.
Western Poultry Packers Limited. Sutton Benger. Wilts.
W. & J. B. Eastwood Limited, Bilsthorpe. Notts.
G. E. Burdge. Corsham. Wilts.
Devon & Somerset Poultry Packers Ltd. (B. A. Langdon & Sons Ltd.) Wiveliscombe. Somerset.
Hinton Packed Products Limited. Norton St. Philip. Somerset.
Princes Risborough Poultry Packers Limited. Loosley Row. Bucks.
Pollastra Packers Limited. Eye. Suffolk.
Lloyd Maunder Limited. Tiverton Junction. Devon.

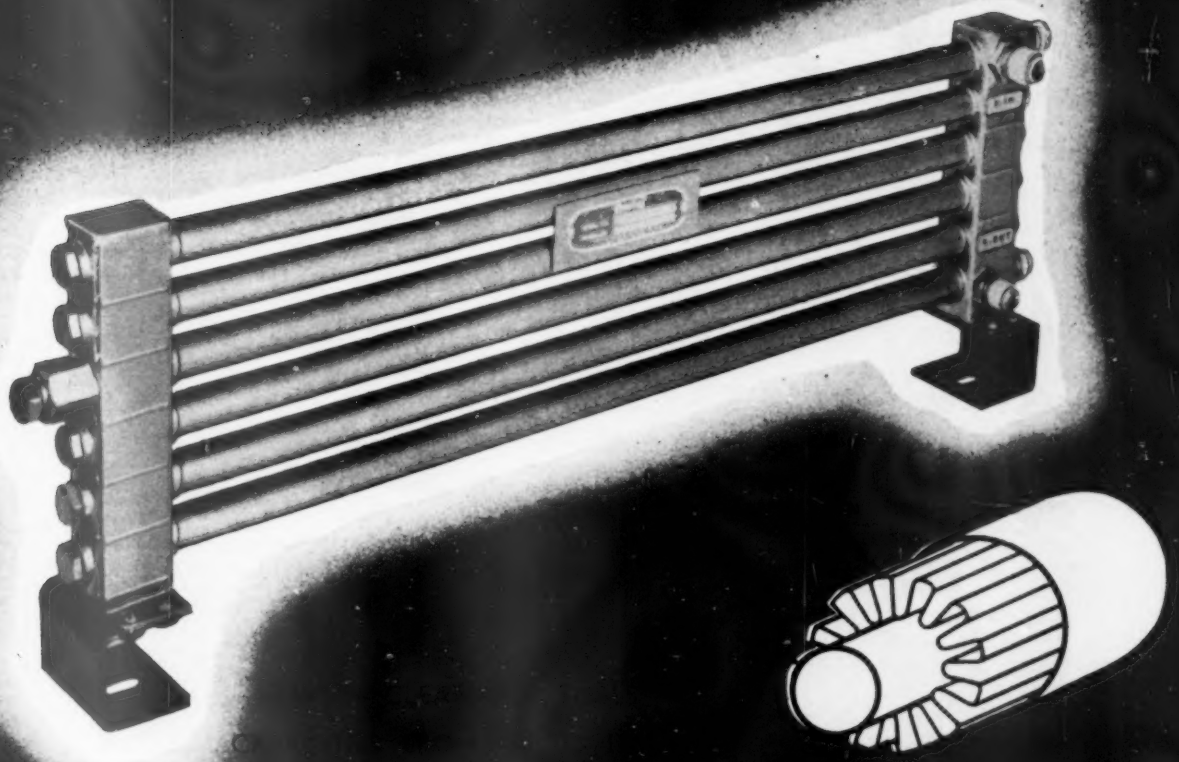
have chosen DOUGLAS QUICK FREEZING PLANT

The DOUGLAS system for QUICK FREEZING poultry
produces a bird of the best possible quality and colour.
It has been specially designed for its purpose and is arranged to fit readily
into the production line.
It is adaptable to any layout and can be arranged to take care of
expanding output as production grows.
If you want to know more about the Douglas quick freeze system,
(and Douglas dry rendering plant which converts waste,
including feathers, to poultry feeding stuffs), write to:

DOUGLAS

WILLIAM DOUGLAS & SONS (ENGINEERING) LIMITED
BREWHOUSE STREET, PUTNEY, LONDON, S.W.15. Telephone: PUTney 9221
A MEMBER OF THE BAKER PERKINS GROUP

heat-x



Here is a compact, efficient, refrigerant condenser for the water-cooled application. The entire water circuit is of non-ferrous construction, with cleanable tubes making it possible to maintain high efficiency.

The inner-fins in the refrigerant tubes permit a compact arrangement and provide many extra square feet of surface. The result is minimum size and maximum heat transfer.

HEAT-X, Inc.

DUNHAM-BUSH

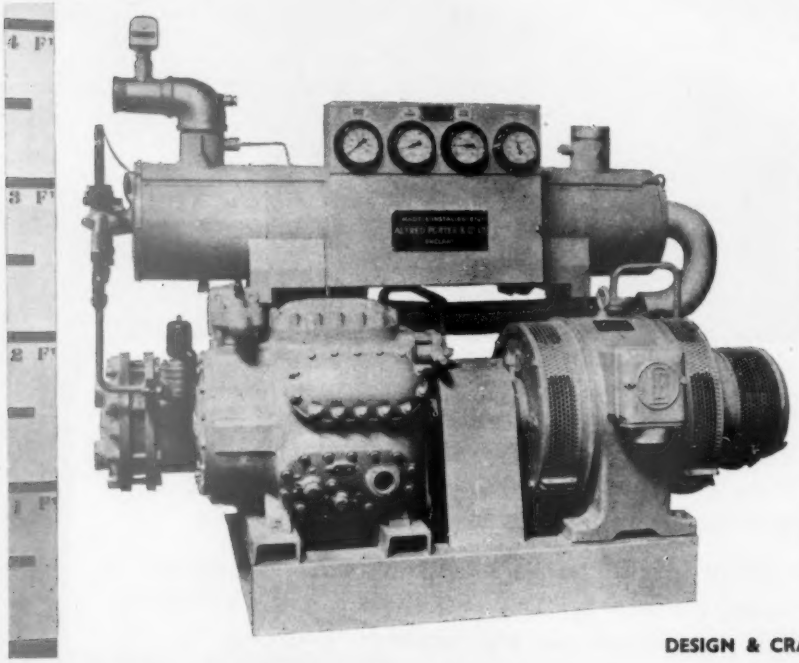
THIS SHRINKING WORLD

and an **EXPANDING** organisation

The giant strides of modern transportation do more than annihilate distance; they can bring you the truly world-wide "know how" of a group of Companies with a refrigeration background of nearly 100 years.
This expanding organisation is a new concept of international co-operation in engineering, and the fruits of this hard-won experience are in the many types of refrigeration plant made available to you by Alfred Porter and Company.

NO CASE FOR WASTE SPACE in the 20 TR Water Chilling set, carefully devised and engineered as a packaged unit. The condenser water pump and the chilled water pump can be accommodated on the same base. Likewise all electric motors can be provided in integral composit panel. The unit is foolproof and protected in every possible way.

The stringent conditions imposed by the Oil Companies' Materials Association Committee are more than fulfilled in the motors, wiring and control gear and all piping and wiring is carried out and rigorously tested in the factory. Installation is a matter of three simple connections: electricity supply to the main isolator, water supply for the condenser, and output for the chilled water service.



COMPRESSOR

Five cylinder W construction 2¾ in. bore x 2 in. stroke, directly driven; four pole electric motor. Inbuilt capacity control.

CONDENSER

Extended surface shell and tube type.

EVAPORATOR

Non-ferrous construction throughout for minimum corrosion. Extended surface tubes, direct expansion, minimum refrigerant charge.

PERFORMANCE

20 tons refrigeration when cooling water to 42°F. with condenser water 80°F. flow.

DIMENSIONS

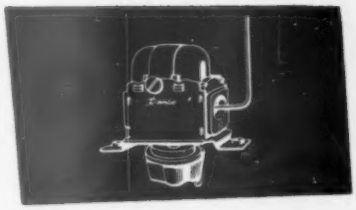
5 ft. long x 3 ft. 4 in. wide x 3 ft. 9 in. high.

DESIGN & CRAFTSMANSHIP AT THEIR BEST!

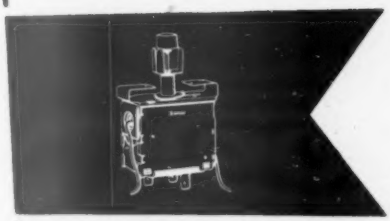
ALFRED PORTER & CO. LTD.

STELLA WORKS, STANLEY RD., TEDDINGTON, MIDDLESEX Teddington Lock 4406-7-8

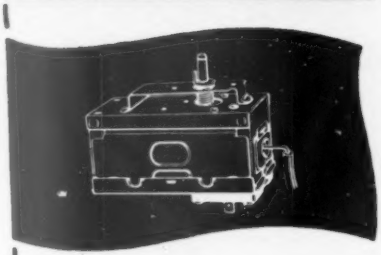
Ranco signals S·U·C·C·E·S·S



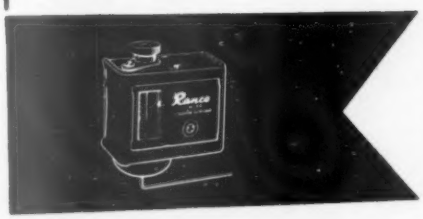
Ranco 'A' series provides a control suitable for all light and medium duty applications. The control can be made available with a single or double throw switch with various temperature ranges and differentials and in many other forms including one for operating a single or alarm circuit.



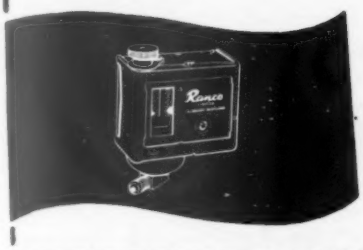
Inexpensive defrosting of domestic refrigerators is made available with the Ranco Push Button 'F' control. Combining the normal temperature control with push button defrosting the 'F' automatically re-starts the compressor after the evaporator has defrosted—returning the push button to the normal position.



Ranco 'E' series controls provide for automatic defrost of refrigerators. The defrost cycle is started at a fixed time each day and stopped at a fixed temperature or after a "time safe" period which ever occurs earliest. Available for hot gas or electric heater defrost systems. Ranco 'E' controls are used in conjunction with the normal thermostat.



Ranco 'O' series temperature controls provide a single-pole snap acting switch either closing the circuit on a rise and opening the circuit on a fall of temperature, or the reserve. The differential screw changes the CUT-OUT only on standard cooling controls: the same adjustment on standard heating control changes the CUT-IN. Graduated visible scales indicate range and differential settings.



For commercial refrigerator applications Ranco supply a very full range of pressure operated controls, in addition to the temperature operated series. These are offered in Low pressure, High pressure and dual high-low pressure ranges, and are available with various operating ranges and differentials.

The Ranco Research team is available to assist in the development of any special project or application.

For further information please write to:—

Ranco Limited,
Technical Sales Division,
54, Cheam Common Road,
Worcester Park, Surrey, England.
Telephone: Derwent 7785 (3 lines)
Telex: 25346

Ranco LTD
TANNOCHSIDE
UDDINGSTON
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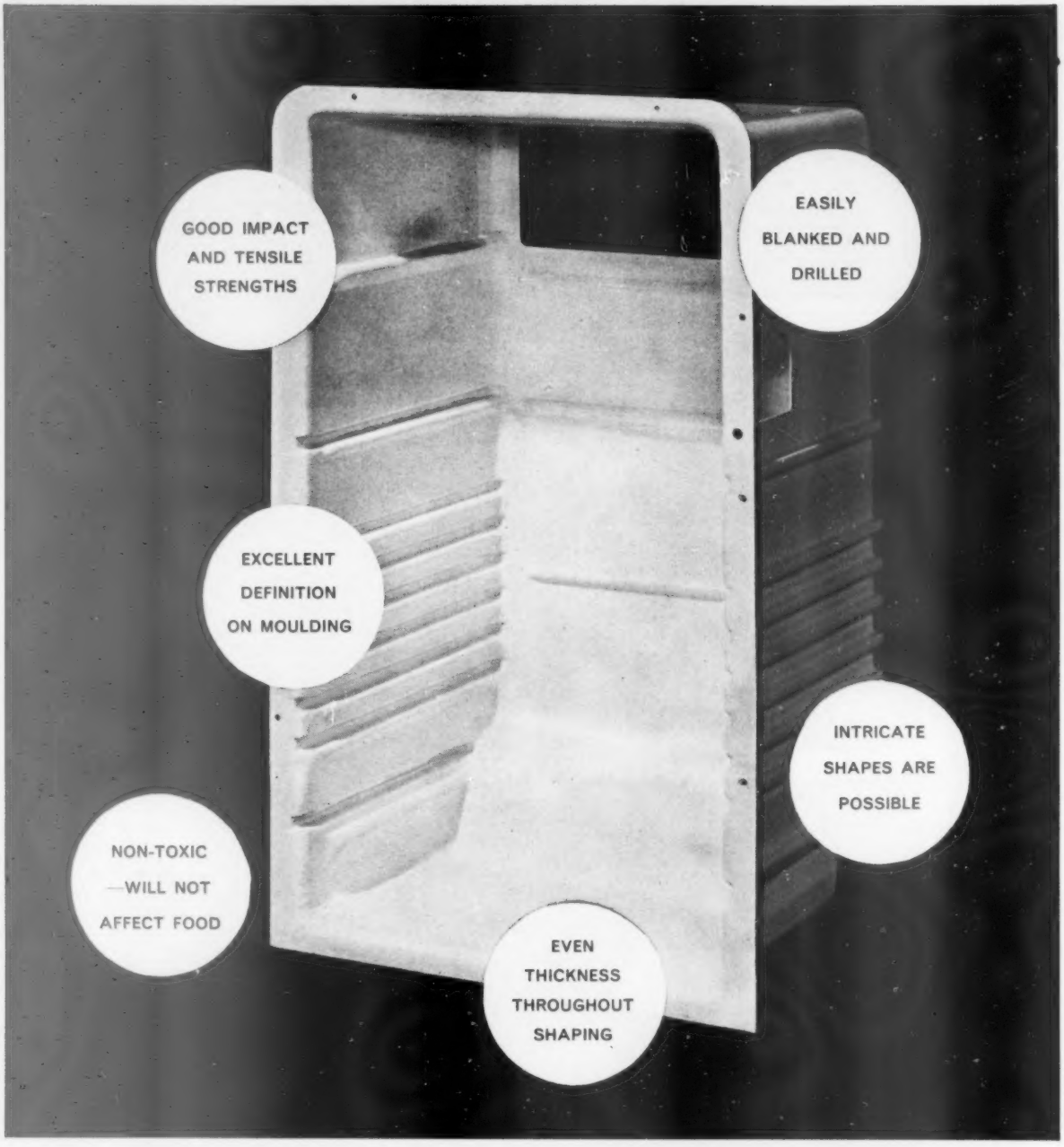
Biggest name in small controls for refrigeration heating & air conditioning


GOOD IMPACT AND TENSILE STRENGTHS
EASILY BLANKED AND DRILLED
EXCELLENT DEFINITION ON MOULDING
INTRICATE SHAPES ARE POSSIBLE
NON-TOXIC —WILL NOT AFFECT FOOD
EVEN THICKNESS THROUGHOUT SHAPING

This refrigerator lining was vacuum-formed from 'Flovic'

'FLOVIC' non-toxic vinyl copolymer sheet can be formed into intricate deep-drawn shapes and shows little tendency to necking or thickness variation, even when considerably stretched.

Shapings in 'FLOVIC' have very good impact and tensile strengths. The high gloss surface finish of 'FLOVIC' sheet can be retained during shaping.

Since 'FLOVIC' contains no lead, tin or any toxic compound of any other heavy metal, shapings made from any colour of 'FLOVIC' now sold can be used in contact with foodstuffs.

'FLOVIC' sheet is an excellent material for liners, door panels and other interior fittings for domestic refrigerators and gives trouble-free use during a long life.

'FLOVIC'

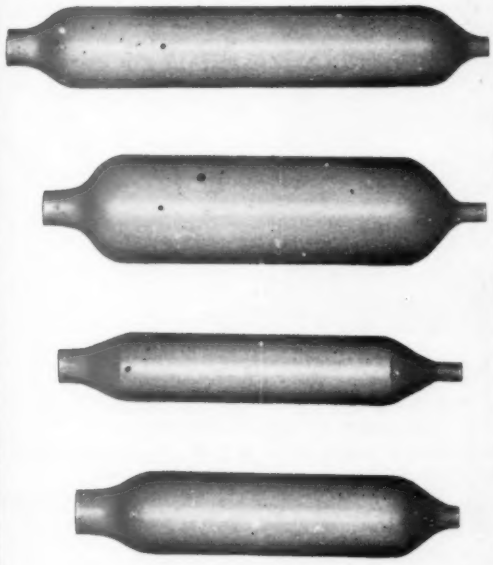
'FLOVIC' is the registered trade mark for the vinyl copolymer sheet manufactured by I.C.I.

ICI IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

PFL3

DAVID SCOTT

9 TIMES AS EFFICIENT AS EXISTING DRIERS



This is good news for all sealed refrigeration system manufacturers. David Scott high side molecular sieve driers are now nine times more efficient than any other driers made. With a desiccant consisting of a molecular sieve filled with type 4A 8 x 12 mesh beads, they have actually nine times the normal adsorption. Consider the economic advantage. With David Scott high side driers you save size and weight.

FIRST CLASS CONSTRUCTION

Construction of these remarkable new driers is carried out in spun copper shell with a desiccant between two fine-mesh strainers. Outlets screen is of bag construction with secure retention in a brass ring pressing. This is formed from a 150 mesh twill weave wire cloth or equivalent in either phosphor bronze or monel.

PRE-PURCHASE PROTECTED

The greatest care is taken to ensure 100% efficiency. All driers are manufactured and stored in an air-conditioned atmosphere.

EASE AND SAFE TRANSPORTATION

Though there is the minimum risk of moisture adsorption from the surrounding atmosphere, David Scott new high side driers can be individually sealed before leaving the factory. All driers are shipped in hermetically sealed canisters.

Inlet and outlet connections conform to manufacturers' own requirements.

Other David Scott products include RECHARGEABLE DRIERS from ¾" o/d to 1¾" o/d pipe, and ACCUMULATOR DRIERS with copper shell squeezed and silver soldered at each end.

A special feature of the David Scott service is the manufacture of driers to clients own specifications.

DAVID SCOTT & CO. LTD.

KELVIN AVENUE, HILLINGTON, GLASGOW

Telephone Halfway 4621

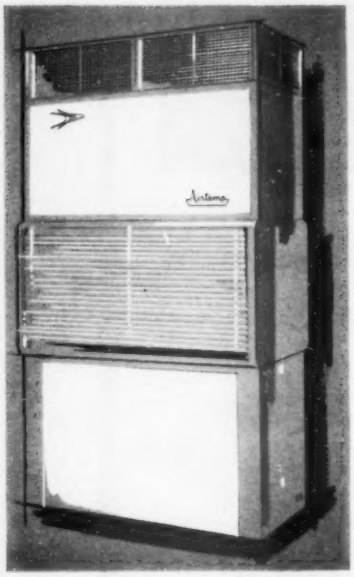
Chrysler... airtemp... packaged unit...

the new concept of air COOLING and CONDITIONING is taking shape

CHRYSLER AIRTEMP. Just a name to engineers in this country, a few months ago. But now it's more than a name. Suddenly, the industry is thinking in terms of CHRYSLER AIRTEMP EQUIPMENT.

There are so many reasons why.

CHRYSLER'S VAST TECHNICAL KNOW-HOW.
CHRYSLER *PACKAGED UNIT* DESIGN.
CHRYSLER'S 300-STRONG RANGE OF UNITS.
CHRYSLER'S STRONGLY COMPETITIVE PRICES.
CHRYSLER'S FLAIR FOR BEING THE INDUSTRY'S LEADER.



EXAMPLE: the 3700 series air cooled unit. Model 3705-00.

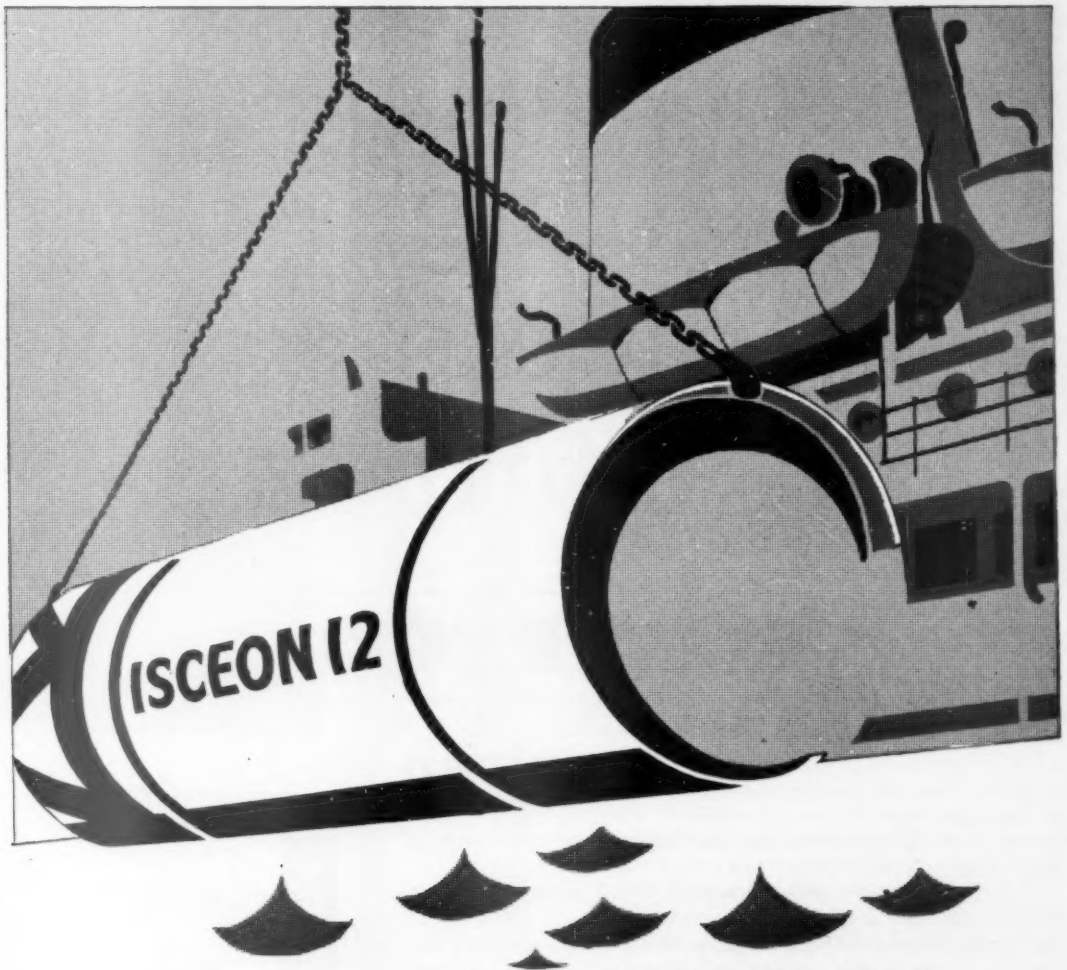
A streamlined packed unit in the 5-30 ton range. Special features include:- Semi-sealed compressor; Noiseless operation; Dimensions of only 8' 6" x 4' x 1' 8"; Adjustable fan speeds; All wiring brought to an integral master control panel; Automatic damper control of head pressure on condenser; Heating coils to suit all site conditions; Throw-away filter.

CHRYSLER
AIRTEMP

A NEW CONCEPT OF COOLING AND CONDITIONING

It will pay you to include Chrysler Airtemp Equipment in your projects. Our Technical Applications Department is at your disposal for advice on any application of Airtemp Equipment. For literature or an appointment with a Chrysler Representative, contact:-

CHRYSLER INTERNATIONAL S.A., Special Products Division, Bowater House, 68 Knightsbridge, London. S.W.1. Telephone: Knightsbridge 6821 (10 lines)



. . . and the Australia run!

Ice cold realism, deep freeze protection, they're taking
abroad the guarantee of perfect refrigeration for the long journey there and back.
Any other healthy reason for selecting ISCEON 12?
Yes. It's non-inflammable, non-combustible, non-irritant
and non-toxic, with the highest degree of purity.
All vital factors, all valid reasons for selecting
ISCEON 12 for refrigeration ships.

A PRODUCT OF IMPERIAL SMELTING

CONSOLIDATED ZINC CORPORATION (SALES) LIMITED
LONDON, W.1

For all sealing problems consult

EVOMASTICS

LIMITED

Evomastics Ltd. produce a very wide range of specialised mastics which solve an infinite number of sealing problems. Whatever your problem, be it joint movement, galvanic corrosion, temperature, solvents or just plain weather, the technical resources of Evomastics are at your service to give you the right answer. The methods of application of mastics are also an important consideration to which Evomastics give close attention and you can be sure of a quick, clean and economical job when you work to their recommendations.

THIS SPACE IS RESERVED FOR YOU

My sealing problem is . . .

POST THIS COUPON FOR FREE SAMPLE

This coupon will bring you a sample of an EVOMASTIC sealing compound for you to examine

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EVOMASTICS LTD., COMMON ROAD, STAFFORD Tel: 2241 (5 lines)

M-W.163

Minimum corrosion, minimum frost build-up with 'THERMOCAL' DF

I.C.I.'s new heat-transfer medium for industrial refrigeration

'THERMOCAL' DF—most anti-corrosive of all glycol based heat-transfer media now employed in industrial refrigeration—is widely used to prevent frost build-up on primary refrigeration coils; it can also be used as the main coolant.

'THERMOCAL' DF sets a new standard of corrosion-resistance—with a corresponding (and profitable) reduction in plant maintenance and stoppages.

Aqueous solutions of 'THERMOCAL' DF freeze well below 0°C. and can be used as defrosting fluids, industrial coolants and heat-transfer media between −40°C. and 100°C. These solutions have outstanding resistance to corrosion, high specific heats and thermal conductivities, long-term stability over a wide range of temperature, low coefficients of expansion and low flammability.

Think about 'THERMOCAL' DF—if you want to know more about it, please write. For a technical visit, please get in touch with your nearest I.C.I. Sales Office.

IMPERIAL CHEMICAL INDUSTRIES LTD.,
LONDON, S.W.1.

H.87

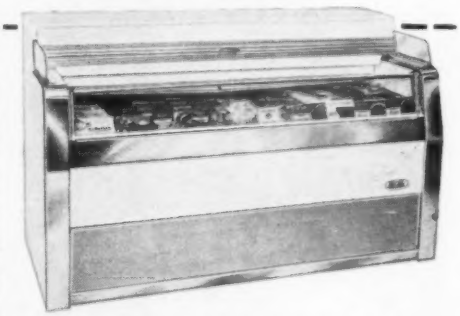
The HELIFROST freezers come to Britain...

HELIFROST is the name of the new, advanced range of deep freezers and frozen food merchandisers introduced to Britain by Elektrohelios of Sweden. Leading Swedish organisation in the domestic electrical appliance field, Elektrohelios is also the largest firm in Europe producing deep-freeze equipment.

In Sweden, Elektrohelios is a household word. The name stands for 40 years' experience of electrical appliance manufacture. One of the company's five factories, that in Mariestad, is the only one in Europe designed exclusively for large-scale quality deep freezer production. There, mass-production is carried out under conditions of continuous quality control. That is one important factor. A second is the use of thoroughly up-to-date technical equipment. Number Three is the close co-operation between Swedish and British experts in their special fields. British manufactured vital parts include the copper tubing—thermostat—the high-capacity Tecumseh compressor by the renowned Sterne of Glasgow organisation. Swedish-British collaboration achieves *utmost dependability*. 'Helifrost' spells good news for the trade.

The Helifrost freezers will be marketed in Great Britain by the Sole Agent in this country, Helimatic Ltd., who will provide nationwide service facilities in close co-operation with the trade.

ELEKTRO HELIOS



Chest freezers from 5.3 cu. ft. to 19.6 cu. ft.; upright freezers from 9 cu. ft. to 20.5 cu. ft.; merchandisers from 11 cu. ft. and automatic defrosting models from 17.5 cu. ft. All Helifrost models are fully guaranteed and covered by warranty arrangements.

Helimatic Ltd.

22-24 BUCKINGHAM PALACE ROAD · LONDON SW1 · Tel: VICTORIA 3056

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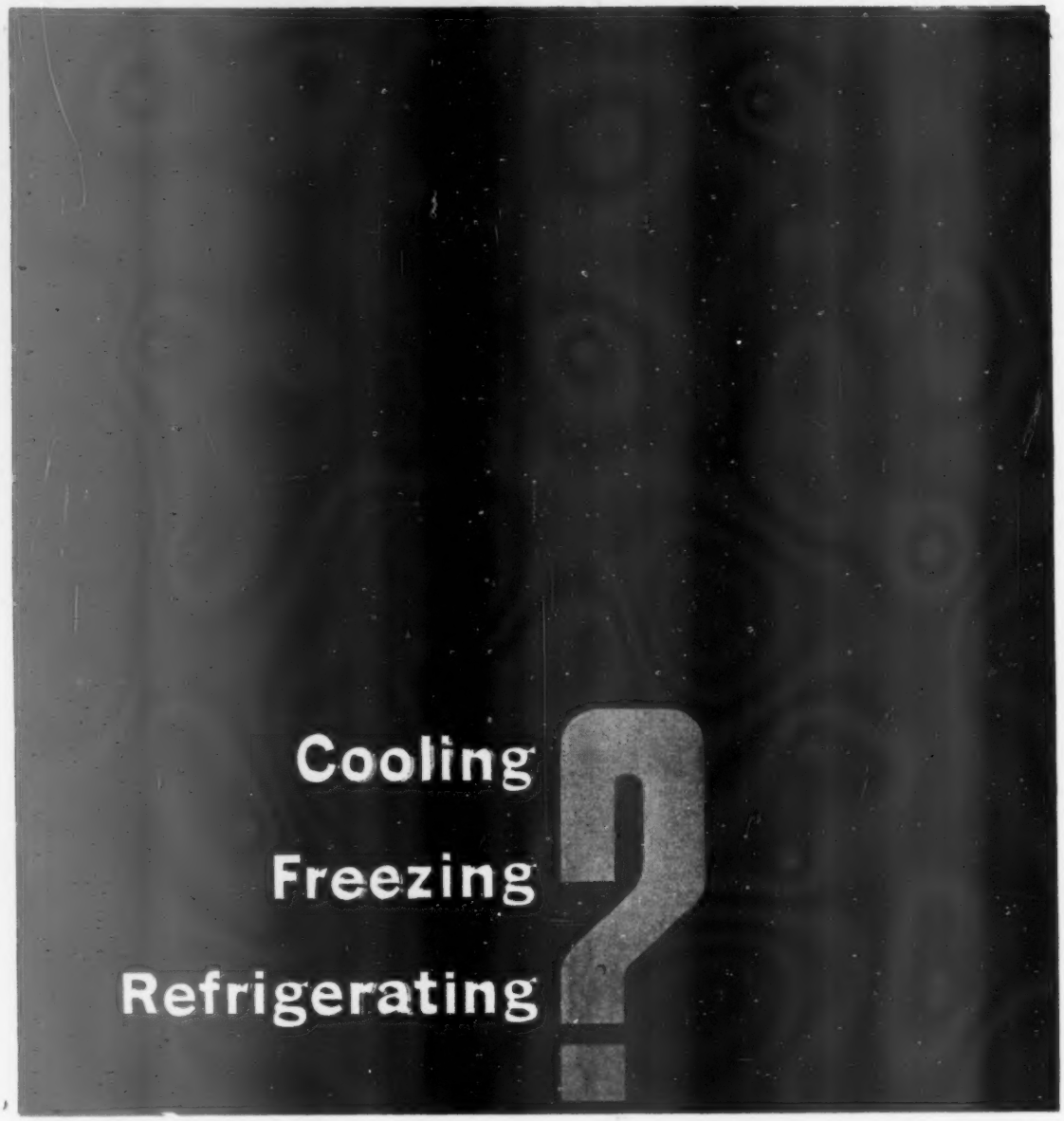

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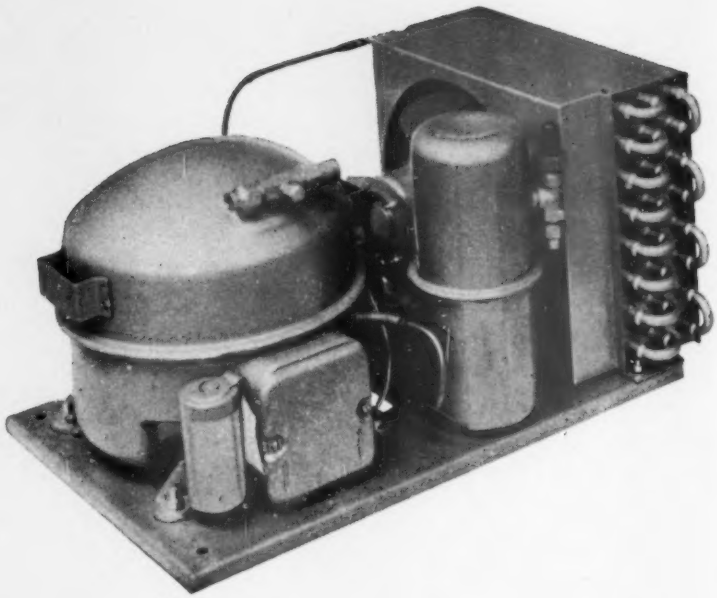

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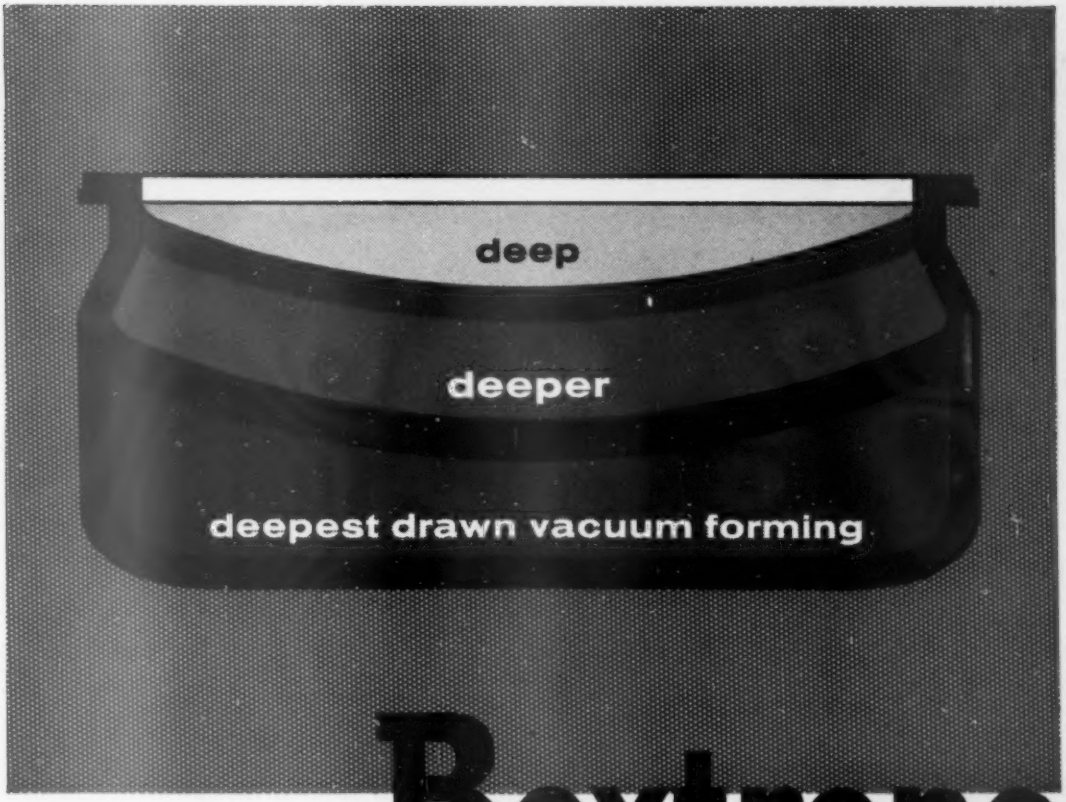

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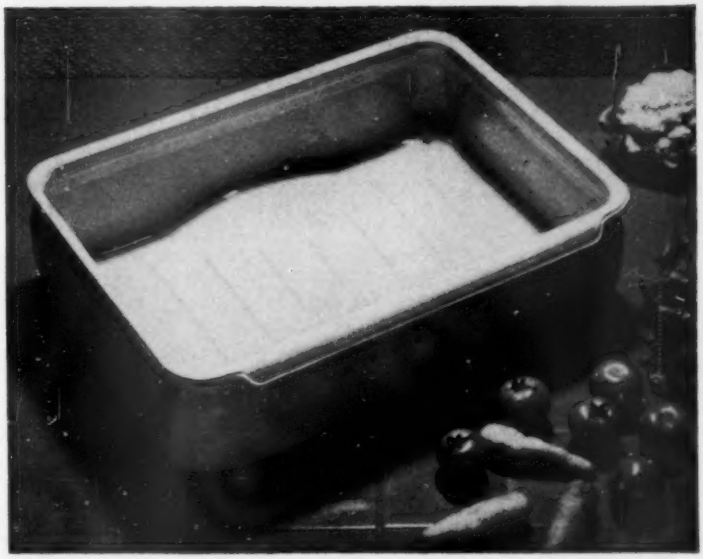

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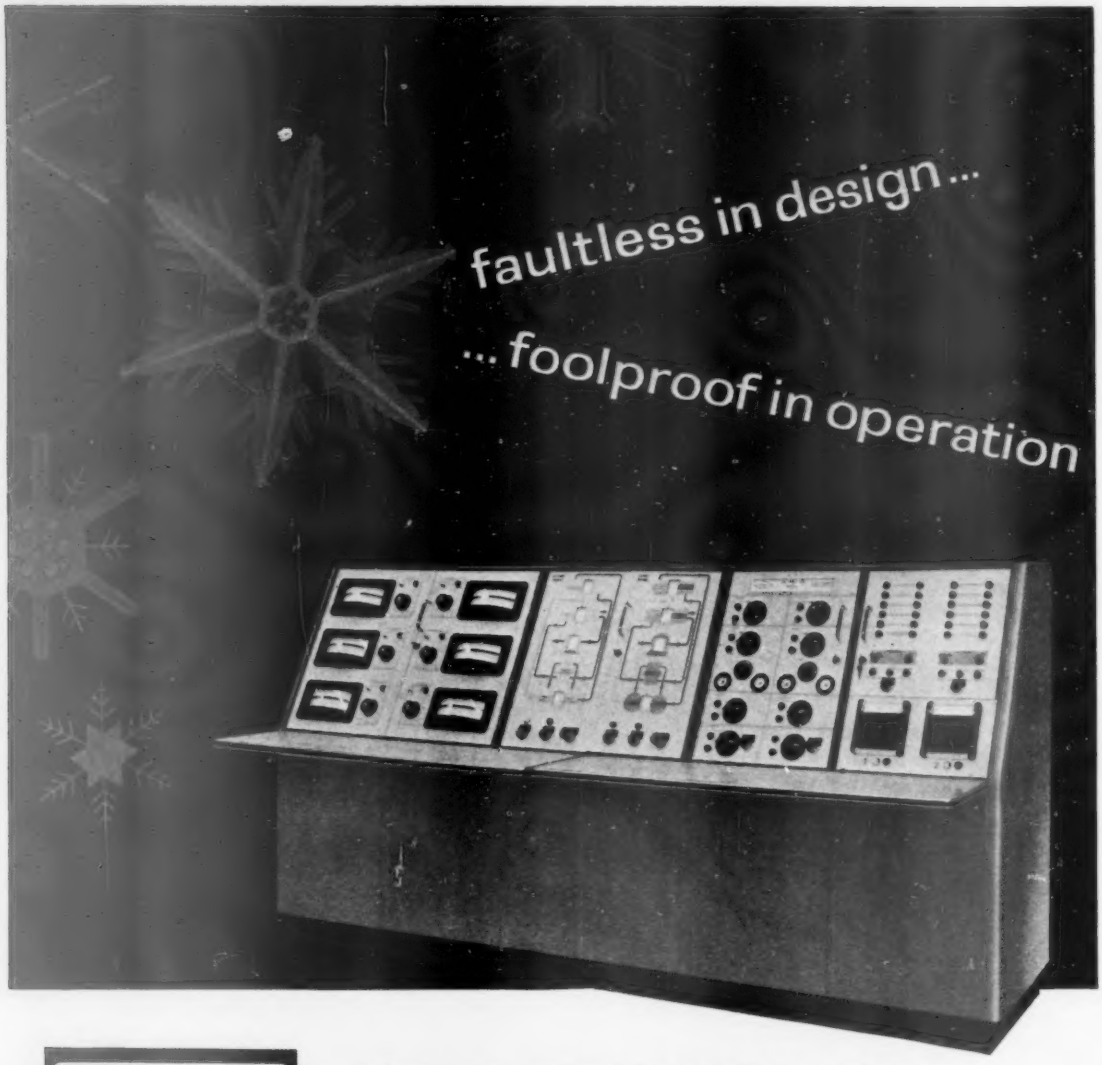

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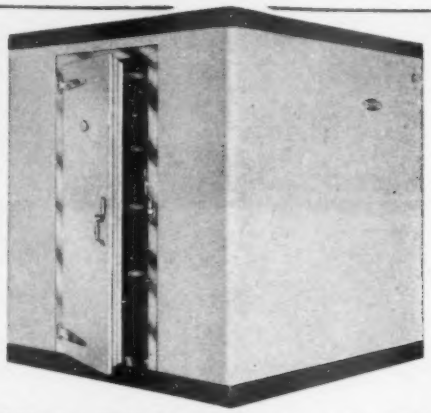

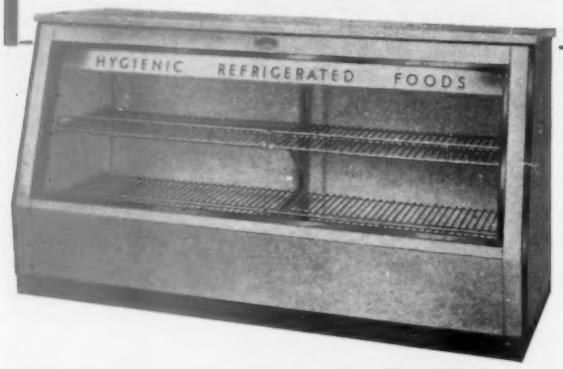

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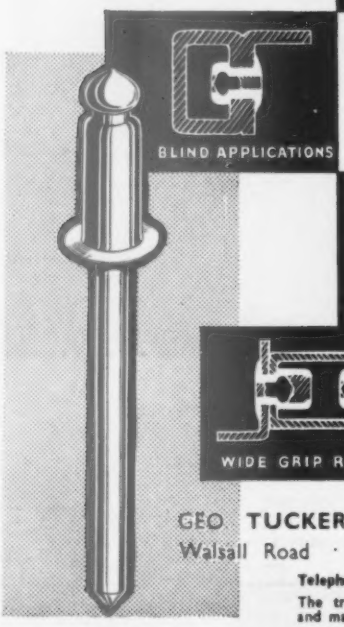

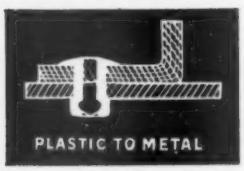

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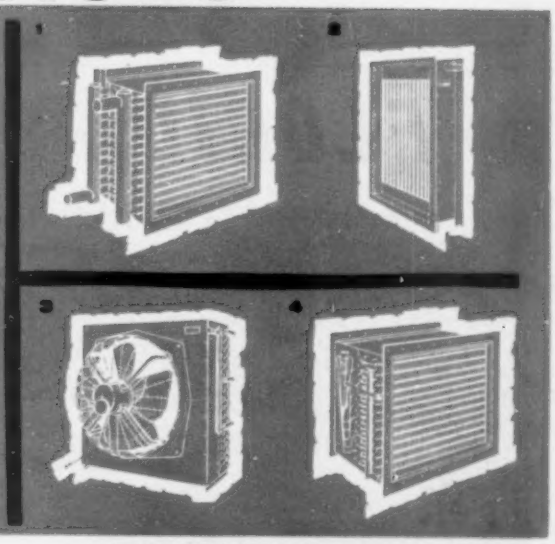

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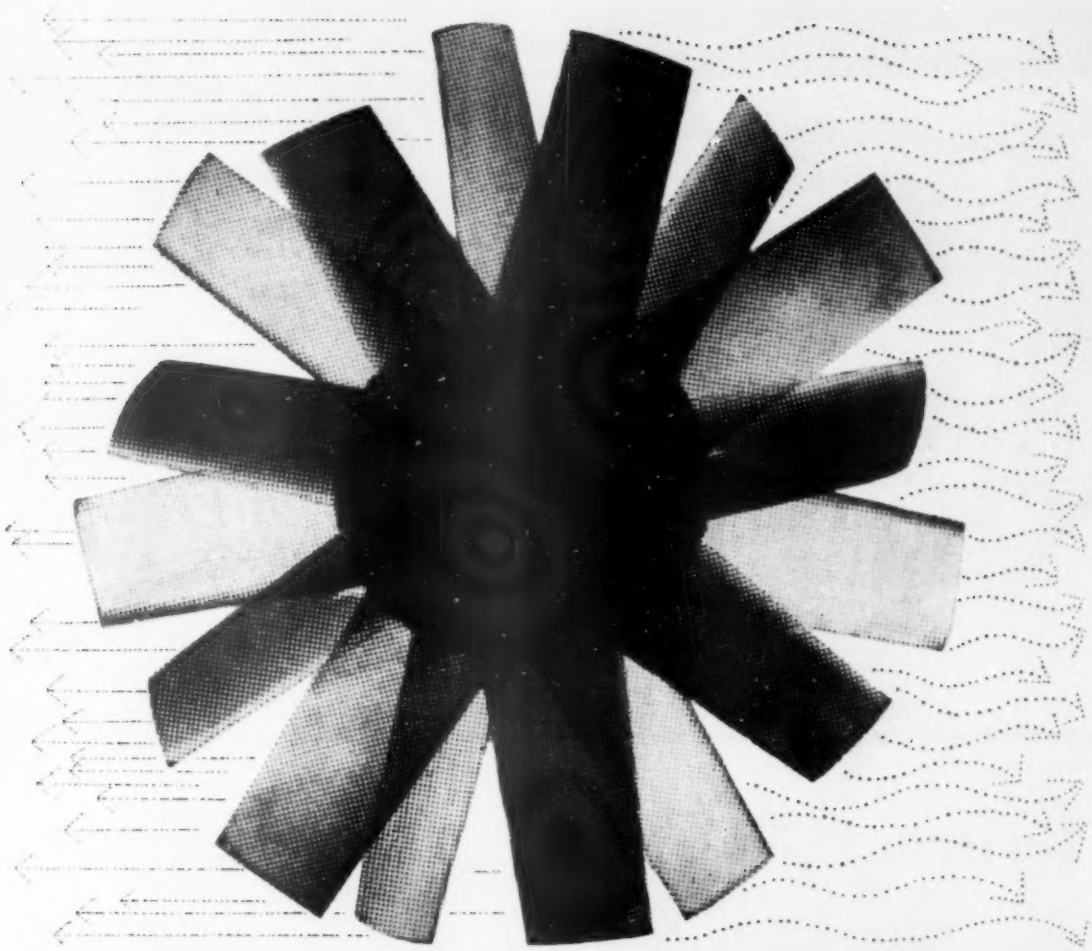

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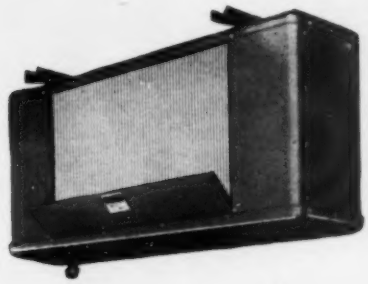

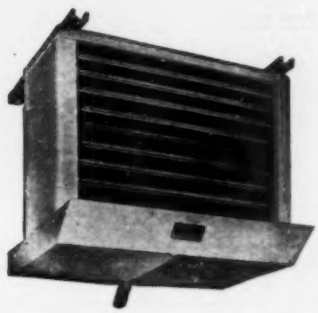

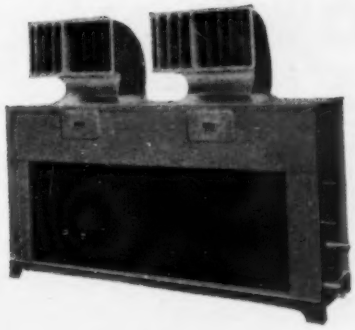

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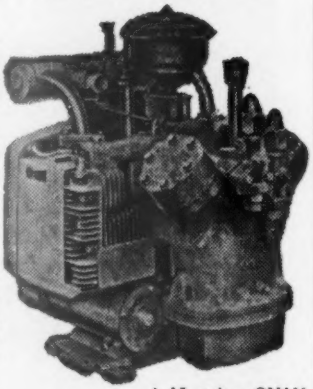

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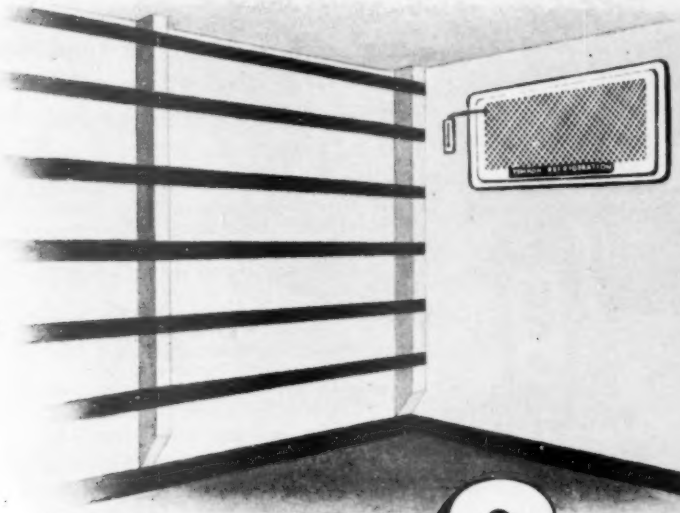

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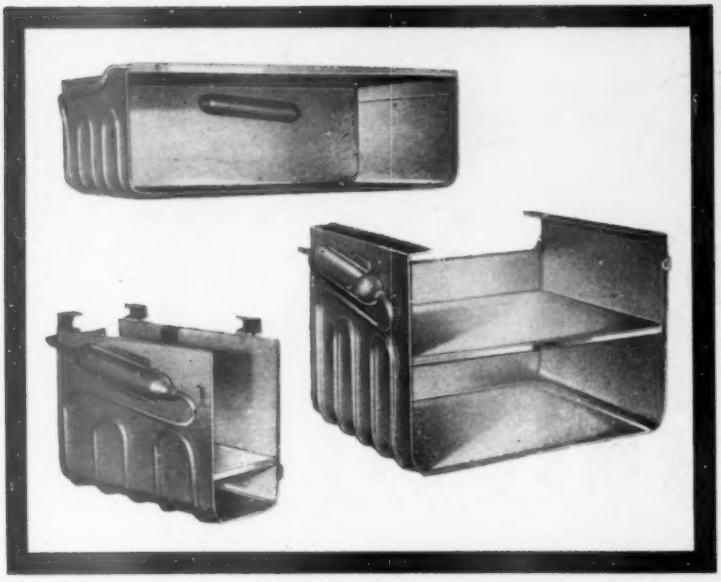

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EL 440	6⅜″	9″	11⅞″	Refrigerated Shelf
EL 360	20½″	8⅝″	12⅝″	Refrigerated Shelf
EL 570	16⅜″	10 11/16″	13″	Refrigerated Shelf
EL 266	16⅜″	10 11/16″	13″	No Shelf
EL 177	6⅜″	8 11/16″	10¾″	Loose Shelf
EL 1020	8 11/16″	5 5/16″	10″	No Shelf
EL 420	12″	10″	12″	Refrigerated Shelf
EL 730	9½″	2⅝″	9 7/32″	
EL 114	9 11/16″	8″	12″	Loose Shelf
EL 435	9 11/16″	8″	12″	Refrigerated Shelf
EL 128	6¾″	7⅞″	10¾″	Refrigerated Shelf
EL 386	6¾″	7⅞″	10¾″	No Shelf
EL 129	18 11/16″	5⅛″	12 11/16″	Refrigerated Top
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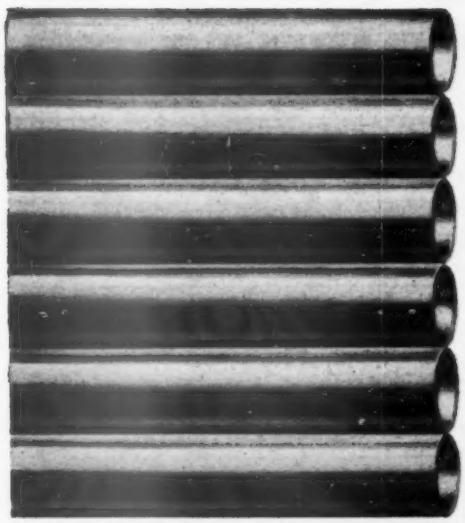

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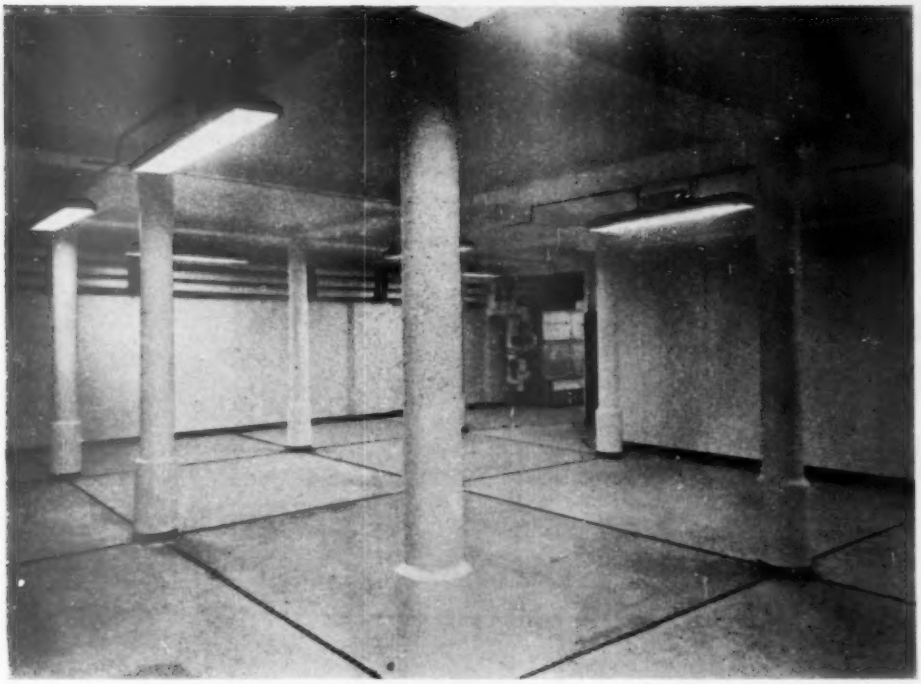

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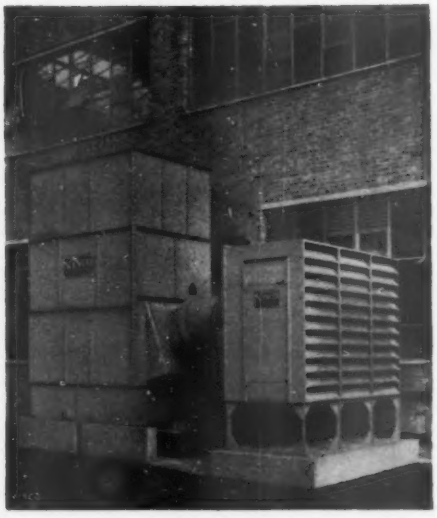

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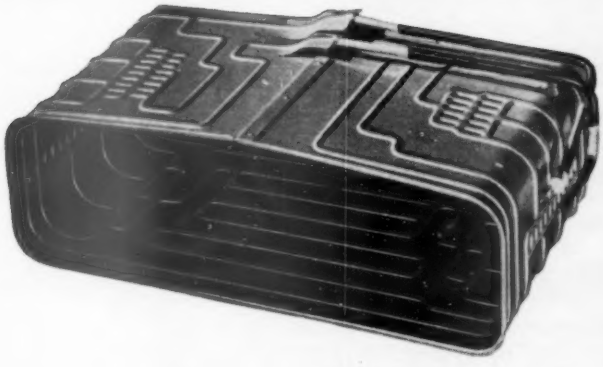

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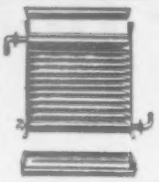

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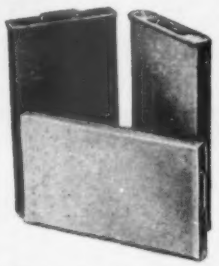

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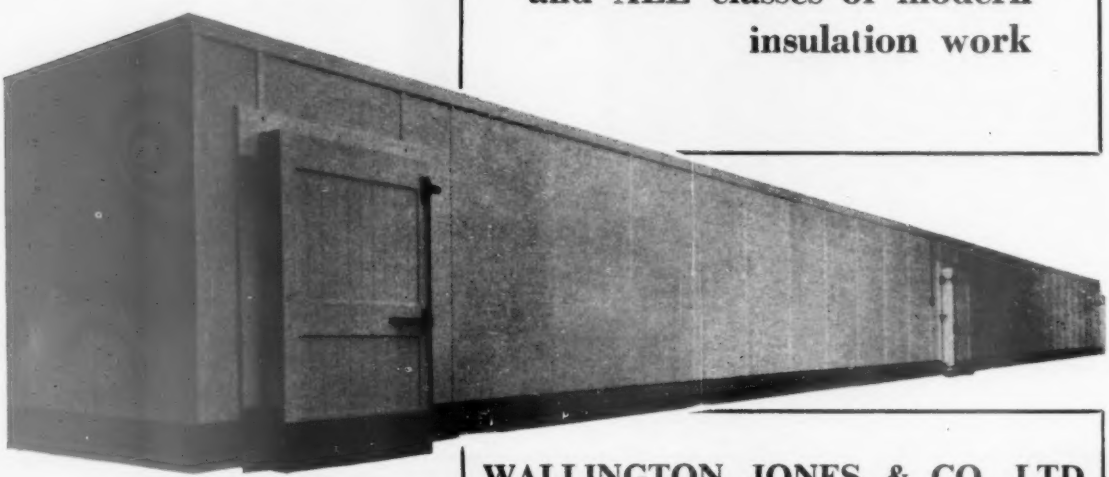

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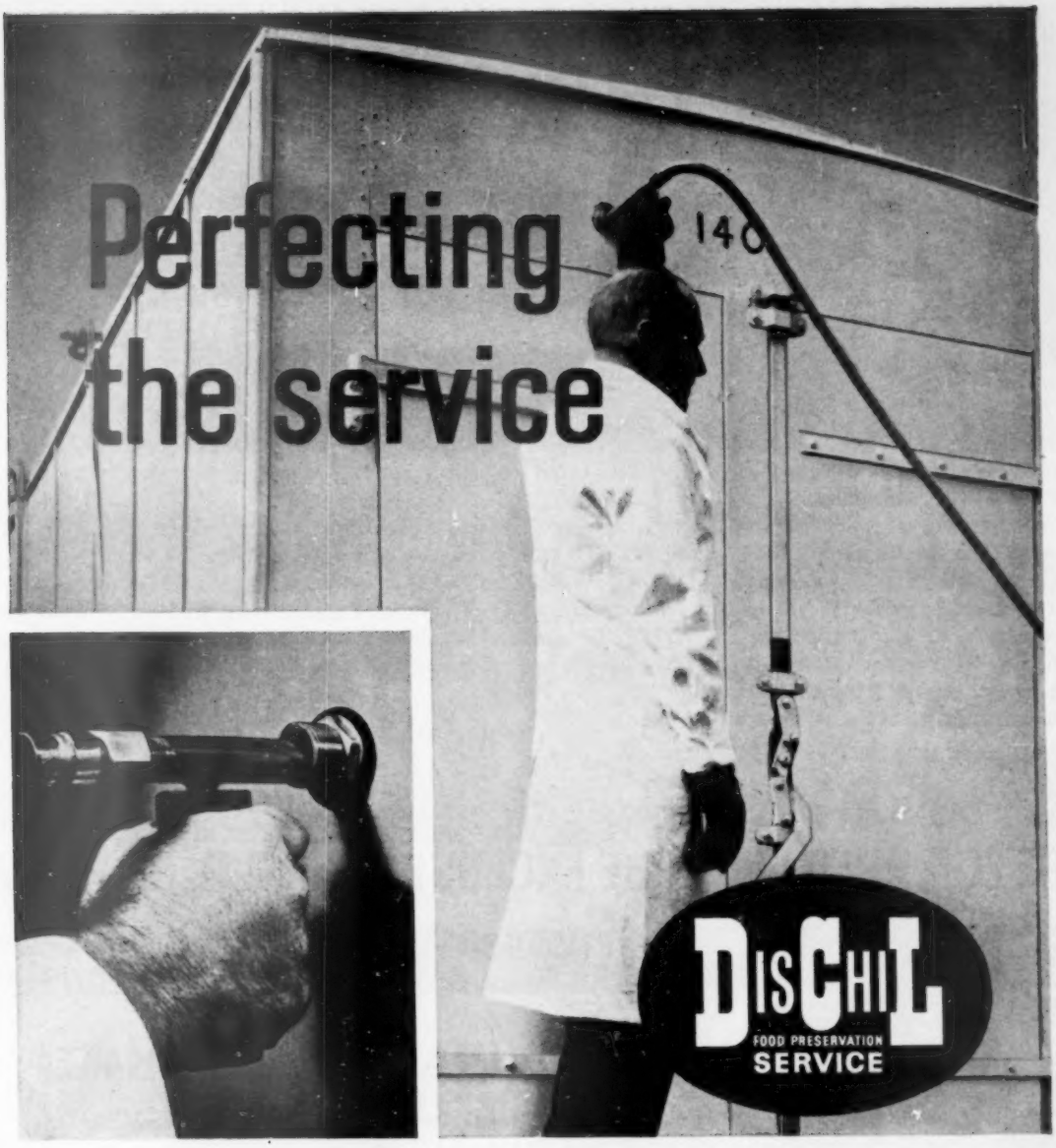

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Meet 'Lady K'

Mr. N. F. T. Saunders
Managing Director, Kelvinator Ltd

"I have explained our 1961 policy. Next year we plan to double our sales, and to support you by doubling again our advertising expenditure.

To achieve our sales objective we are extending our present range with a 3 cu. ft. refrigerator, the Lady K. This new addition to the Kelvinator family offers you the greatest opportunity yet in the smaller refrigerator market—the biggest selling market in the industry. With a range from 3 cu. ft. to 9·4 cu. ft. we can now challenge 100% of the market. The Lady K will be fitted with the exclusive Kelvinator ZERO-PLUS freezer chest, providing safe storage of ice cream and frozen food in perfect condition for up to 3 months. In our new 4·6 cu. ft. cabinet, the K46ZP, also announced today, we are again fitting a Zero-Plus freezer. This means that our complete range will offer this remarkable feature. The Zero-Plus freezer is capable of maintaining temperatures between zero and plus 5°F., with balanced temperatures throughout the main storage compartment."

ALL 1961 MODELS, INCLUDING THE FABULOUS NEW K46ZP, WILL BE EQUIPPED WITH THE EXCLUSIVE ZERO-PLUS FREEZER

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* Door opens within width of cabinet
* Available in gleaming white or champagne ivory

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challenges 100% of the market!

Keenly priced at

50 gns. incl. p.t.

Lady K has all these extras

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* Rapid ice-cube maker
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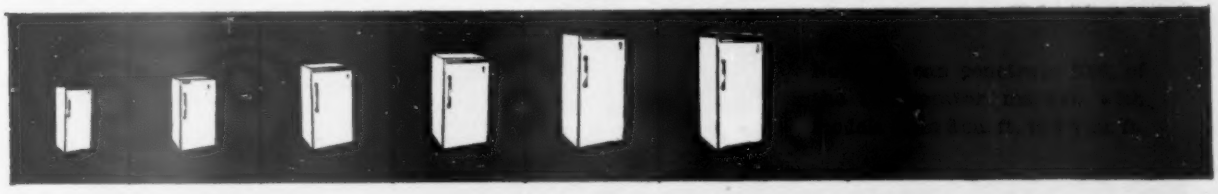
Lady K goes everywhere

1. Can be fitted on your kitchen wall, using wall hanging kit, FREE on request.*
2. Can be built-in with modern kitchen units and completed by using the specially designed fascia.*
3. Optional tray-top, available at a slight extra cost. This provides an additional working surface by bringing Lady K to the normal working height.
4. Will stand on convenient units or cupboards.
5. Free standing.
6. Can be installed beneath any working surface of normal height

* As an extra service which you and your customer will appreciate, Kelvinator will forward her direct, on request, the free wall hanging kit. The building-in fascia can also be supplied direct, at slight extra cost. This service is designed for speed and will not involve you in any additional stocking or expense.

Lady K will be launched in early 1961 with nation-wide publicity



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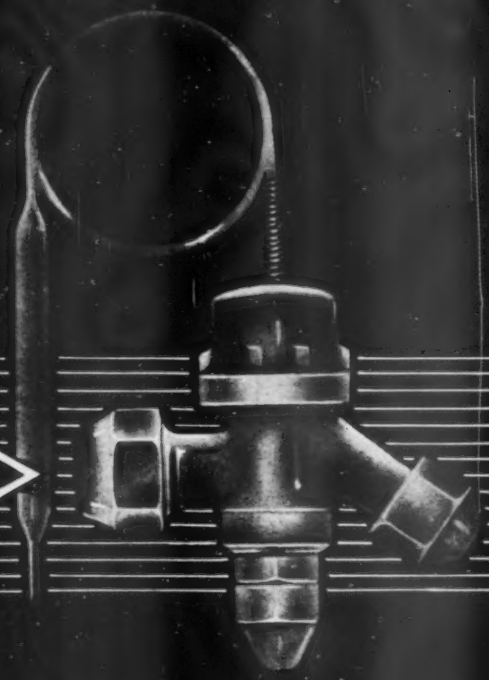

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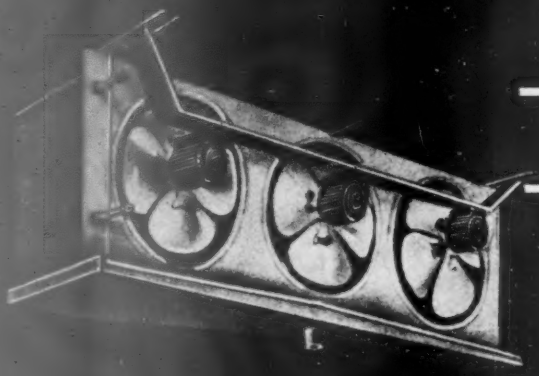

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NO BOREDOM IN THIS JOB. Suit Tech. Sales Eng., Service Manager, progressive service man, or similar who has reasonable basic knowledge of refrigeration. Certain amount of selling in British Isles, some office work, etc. Ideal age early twenties. Job based in London as Director's assistant. Good salary according qualifications. Write Refrigerator Components Ltd., 1 & 2 Greycoat Place, Westminster, S.W.1 or 'phone ABBey 1514. 84

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Duties under guidance at commencement will include design, preparation of tenders and contract work with an increasing share of responsibility. Excellent prospects. All applications treated in strictest confidence.

Apply for an interview, stating age, qualifications and experience to:—

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Established 1898

VOLUME 63 NUMBER 752

NOVEMBER · 1960

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Editorial . . . .

British Refrigerator Industry

Makers ready for next round

Distributor Relations

● Despite the fact that they have only just emerged from a heartbreaking selling season, resulting in a piling of stocks, leading British makers of domestic refrigerators have lately announced many brand new models—ahead of their usual schedule. The rigours of the summer have assuredly sharpened the determination of these producers to enter the next round with every advantage which they can command. Details of several of these new models are to be found in this issue.

● The demand for British-made domestic refrigerators fell sharply during September, according to the figures recently issued by the Domestic Refrigeration Development Committee. Manufacturers' deliveries to the home market, a total of 27,248, were no less than 65 per cent lower than September last year, when they totalled 77,106. This fall, although substantial, did not take the industry by surprise. It was known by the manufacturers, some time ago, that the full effects of the credit restrictions would be felt during the month of September. Total deliveries to the home market of domestic refrigerators from January to September inclusive are still 20 per cent higher than those for the same period in 1959—832,586 compared with 694,534. Exports continue on a high level. September deliveries of domestic refrigerators to the export market, a total of 11,571, showed an increase of 40 per cent on September last year, when export sales were 8,250. The total for the first nine months of the year was 107,104—41·9 per cent higher than in the same period of 1959.

● The best-known British refrigerators all now have the sheer look. Indeed, it could be said that they are " squaring up " to the fight ahead and by all appearances these new cabinets from Swansea, Hendon, Bromborough and elsewhere will once more confirm the view that " made in Britain " is a tag worth seeking out.

● Many significant changes have taken place in the post-war commercial and domestic refrigeration industry, particularly in manufacturer/distributor relationships. Perhaps one of the more obvious is the concentration of the larger factories on " packaged " items, leaving the " specials " or " one-offs " to be fabricated by the distributors. Another far-reaching development is the programme of acquisition of its distributors by one of the biggest producers of commercial and domestic refrigerators. The opening last month of a new Prestcold branch at Worcester was in line with this new expansion of their marketing organization.

● During the next three years, Prestcold intend to acquire the businesses of their distributors in England and, in their place, create regional marketing units which will, within limits, be autonomous in their operation. A number of these businesses have already been purchased and negotiations are now being carried out for others. These marketing units will operate under the control of a regional manager and his staff who will undertake responsibility for the selling of commercial and industrial refrigeration equipment, together with the distribution of domestic refrigerators and any other appliances which will be manufactured by Prestcold. In addition, complete service facilities will be available in each region. When this plan is completed, Prestcold will undoubtedly possess a marketing organization second to none in Great Britain.

● Prestcold's factory at Swansea was first brought into production last March at a cost of £5,000,000 ; although it will be some months before it is in full production, already finished goods are beginning to flow from the production lines. In due course the factory will make not only commercial and domestic refrigerators, but also other new appliances.

● Down in Victorian Tunbridge Wells there is a clinic which, like the old spa, has a definitely Roman atmosphere. For here, to put it in basic English, they believe in " sweating it out." Readers will have read in these columns before of the doctrines of Dr. E. F. St. John Lyburn. It was about eight years ago that Dr. Lyburn began to investigate the physiology of the skin and sweat glands under wet heat, for he believes that the fundamental cause of all chronic disease and ageing in man is the degeneration and infection of the liver and kidneys—the main filters of the body—also the closing of the blood vessels with cholestrol, followed by the tiny capillaries getting thrombosed and furred up. This prevents the oxygen and fuel being supplied to the cells and the poisons of cell activity being taken away in the bloodwater for liver and kidneys to excrete and the lungs to exhale CO_2. If one keeps man's skin wet and moist under steam, claims Dr. Lyburn, or even sweating under plastic to prevent evaporation at 100 °F. man can get an extra kidney for cleaning his blood and prevent thrombosis. With refrigerated air to cool the blood supply to his brain and prevent heat stroke, man's body can be taken to relatively high temperatures artificially.

● The method adopted for achieving therapeutic sweating is by using a wet thermal box and a dry thermal box, or for prolonged treatment of several days, a heated bed in which the subject rests, developed by Dr. Lyburn and Stanley Cox Ltd. The wet thermal box has been designed so that man can be exposed to high wet temperatures up to 118° F. on the body, while his head is exposed to temperatures below freezing. Under wet heat conditions, the sweat, not being allowed to evaporate, no longer cools the skin ; therefore, to ensure that thermal balance is maintained it is necessary to have the head enclosed in a refrigerated chamber. Direct cooling of the head through contact with refrigerated towels round the neck combined with the cold inspired air, keeps the internal body temperature at about normal, well below the high skin temperature in the wet bath. The doctor has found that under these conditions a subject can safely be treated for 20 minutes without fatigue and with the mouth temperature remaining at about normal.

● The wet thermal box consists of two compartments, one a refrigerated chamber with an internal fan circulating the cold air for the head, the other containing an open-topped electrically controlled, water boiler under a seat and a floor heater to maintain steam temperature at the feet as well as around the heart. Thermometers in each compartment give visual indication outside the unit, and provision is made for a stethoscope or cardiac monitor to register the heart rate. A side inspection window in the head compartment may be opened for checking respiration,

and mouth temperatures, as well as for conversation with the subject. After exposure to the wet thermal box, the subject is removed, cocooned in plastic sheeting, and put lying down with the head exposed, which represents 9 per cent of body surface, to the draught from a fan at ambient temperatures of 55° to 65° F., in what is termed the dry thermal box. A wet towel should be placed over the forehead on which cold water can be applied at intervals. It should be noted here that the sweat again is unable to evaporate on all the surfaces of the body except the head. The subject can be kept under these dry heat conditions for from 30 minutes to 2 hours.

● There has been a heavy rush for exhibit space in the 15th International Heating & Air-Conditioning Exposition, due to take place at Chicago's International Amphitheatre from February 13 to 16 next. Sponsored by the American Society of Heating, Refrigerating and Air-conditioning Engineers and in conjunction with the society's national meeting in Chicago, the event will cover every phase of the vast heating, refrigeration and ventilation industry. Specialized equipment on display will include complete systems and components for all types of commercial, institutional, industrial and domestic installations. Represented among the more than 500 exhibits will also be displays of the materials, parts, supplies and tools used throughout the industry.

● Anticipating a greatly increased attendance at the ASHRAE meetings and exposition, over 6,000 hotel rooms have been set aside at leading Chicago hotels. While air-conditioning is a relatively new industry, even in America, the replacement market in some fields is attaining proportions which should make it a considerable factor in future marketing plans of the industry. This is indicated by a recent survey by the drug trade publication *Drug Topics*. This found that 2,437 drug stores added new air-conditioning equipment last year and that there were 2,340 replacements of old equipment in stores previously air-conditioned. " Drug stores were among the first commercial establishments to install air-conditioning," if has been pointed out by Geo. S. Jones, Jnr., managing director of the Air-Conditioning and Refrigeration Institute, " and it is readily understandable that some of the pre-World War II equipment, and some of that installed immediately after that conflict, is now being replaced by more modern equipment which permits better control, not only of temperature but of humidity and air-distribution." According to Mr. Jones, almost three-quarters of the drug stores in America were air-conditioned at the end of 1959. Another feature of the survey of interest to the air-conditioning and refrigeration industry has to do with their soda fountains, virtually all of which include refrigeration equipment. Installations, remodellings and modernizations of this type of equipment were made last year in 3,035 different drug stores.

● The way in which American air-conditioning is being quietly promoted abroad, through installation in exhibition booths and stands organized for American organizations, has been lately stressed by Mr. Jones. " Wherever the U.S. exhibits frozen food and perishable beverages, refrigeration is necessary," he said. " The prescription department and the luncheon counter at this autumn's Drug Fair at Zagreb was so fitted out—as was the Rexall Drug Store in Poland last year. In New Delhi, at the World Agricultural Fair, the American demonstration of a milk recombining plant called for refrigeration. This was also true in Poland, a year back, where the agricultural part of the show needed a cooling tank for the milk." In Milan, where the U.S. staged a show that emphasized " testing and quality control of consumer products," 500,000 or so Italians, said Mr. Jones, saw a United States manufacturer subject a refrigerator to considerable abuse by constantly opening and shutting the door, testing in a very short time the equivalent of many years of use by a family.

● " Similarly, the refrigerator's sealed-in compressor, enclosed in clear plastic, was subjected to severe tests. In Moscow, he went on, aside from the usual amount of refrigeration needed at a soda fountain in the U.S. exhibit there last year, the American pavilion contained water coolers, home freezers, and both domestic and commercial air-conditioning.

BRITISH TRADE FAIR IN MOSCOW

Tremendous interest has been aroused in British industry by the announcement last month that a British Trade Fair will be held in Moscow from May 19 to June 4, 1961. The Exhibition is being organized by Industrial and Trade Fairs Ltd. of which the Earl of Drogheda is chairman. The object of the fair is to increase British exports to the Soviet Union, or, more specifically, to sell the exhibitors' products. Exhibitors will be displaying products which they believe that the Soviet foreign trade organizations wish to buy. They will not be showing products for which they do not think there will be a market in the Soviet Union. These are the factors which have determined the industrial structure of the fair and which account for the high proportion of capital goods among the exhibits. Hall-Thermotank Ltd. will be showing and their exhibit at Moscow will be representative of most of the group's main activities—refrigerating machinery, air-conditioning equipment, ventilating fans, and reinforced plastics. There are also companies within the group which specialise in diffused, shadowless lighting and in acoustic control. Each of these activities will be represented at Moscow. One of the principal exhibits is a model blast freezer tunnel for the quick-freezing of poultry. L. Sterne & Co. Ltd.'s complete range of hermetically-sealed refrigeration compressors will be on view on the company's stand. These will range from 1/12th h.p. right through to 2 h.p. These compressors are of the smallest possible size and represent the modern trend in refrigeration design for maximum storage space and minimum machinery compartment. The stand will have tartan drapes of eye-catching design. Other British refrigeration makers taking space are U.D. Engineering Co. Ltd., Ranco Ltd., Hawker Siddeley Ltd., Heenan & Froude Ltd., Vickers-Armstrongs Ltd. and G. Williams Engineering Co. Ltd.

Refrigeration Press Ltd. is taking steps to have " Modern Refrigeration " and " The British Refrigeration and Air-Conditioning Handbook" on display at The Fair in Sokolniki Park, Moscow.

NEWS OF THE MONTH

Refrigeration and A-c Exports.—During September, 1960, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £819,649 weighing 1,146 tons, was exported from the United Kingdom. Comparable figures for September, 1959, were 1,017 tons, worth £696,019.

* * *

Exports' Analysis.—Of the 1,146 tons of air-conditioning and refrigerating plant worth £819,649 exported by Great Britain in September—quoted in the preceding paragraph — 37 tons went to the Union of South Africa, 47 tons to India, 74 tons to Australia, 22 tons to New Zealand, 84 tons to Canada, 204 tons to "other Commonwealth countries," 47 tons to Eire, 80 tons to Sweden, 146 tons to Western Germany, 80 tons to the Netherlands, 24 tons to Belgium, 9 tons to France, 24 tons to Italy, and 268 tons to "other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during September, commercial refrigerating machinery accounted for 58 tons, worth £38,191, industrial plant and equipment for 313 tons worth £155,406, and refrigerating machinery, equipment and parts for 507 tons, worth £432,849.

* * *

Exports of Small Refrigerators.—During September, 1,181 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £722,021. The 1,181 tons comprised 16 tons to the Union of South Africa, 25 tons to Rhodesia and Nyasaland, 4 tons to India, 86 tons to New Zealand, 592 tons to "other Commonwealth countries and Eire," 65 tons to Sweden, 98 tons to Western Germany, 10 tons to the Netherlands, 5 tons to Belgium, 7 tons to Italy, and 273 tons to "other foreign countries."

* * *

New Ice Plant.—J. and M. Shearer of Lerwick have ordered new ice-producing plant for their factory at Lerwick to meet the growing demand for ice from the fishing fleets in this area. For some time the output at the plant has been unable to cope with business, particularly during the peak summer fishing season. This is the only major ice making factory north of Fraserburgh and one which supplies the boats of many nationalities using the Shetland waters. When the new plant has been installed, in time for next year, capacity will be increased to 40 tons.

* * *

New Processing Plant.—Lincolnshire Canners Ltd. are planning a new factory at Arbroath for the handling of fruits and produce in that area. This new unit will be located adjoining the Metal Box Co. Ltd. plant which is a new development for Scotland. The B.O.T. has given approval for the erection of the factory but planning permission has not yet been sought. Fruit and vegetable processing has been developing steadily in this part of Scotland over the post-war years, encouraged by the excellent production and quality of foods available for this work. A considerable number of national concerns have located here and have created refrigerated storage systems to hold their bulk supplies at peak periods. Frozen food production is also receiving increasing attention from the firms in this field in the Angus and Perthshire areas and further developments are expected.

* * *

Air-Conditioning the "Andes."—The Royal Mail liner *Andes* has been fully air-conditioned. To augment existing refrigerating plant aboard this ship two package brine cooling sets by York Shipley Ltd. have been included in the air-conditioning scheme to provide treated air throughout the public rooms and passenger cabins. This 27,000-ton vessel has recently been completely refitted and modernized. Each of the sets has a capacity of 1,400,000 B.t.u. per hour and comprises a 16 cylinder 3¾ in. by 3 in. VW compressor, shell and tube cooler and condenser with special marine cupro nickel tubes and sheets. The *Andes* was built at Belfast by Harland and Wolff Ltd. more than 20 years ago. After operating as a troopship during the war she sailed on the company's run to South America. She is now to be employed as a full-time cruise ship.

This photograph was taken at the works of Hazell Watson & Viney, printers, of Aylesbury. It shows a layer of ball chroffles blanketing the surface of a large chrome bath used for chromium facing electros and original printing plates. The bath frequently operates at temperatures of 120°F and the chrome solution used is extremely corrosive. The ball chroffles are blow-moulded by Lacrinoid Products Limited and are sold by W. Canning & Co. Ltd.

PRESTCOLD OPEN NEW BRANCH

IN line with a scheme covering the development of their marketing organization, Prestcold have opened a new branch at Worcester. Mr. D. A. Field, sales director of Prestcold and chief speaker at the opening function held in the new showroom at 30, Barbourne Road, gave an outline of the marketing plan.

The opening of a branch at Worcester, he said, was part of a large expansion plan, the heart of which was the company's new refrigerator factory at Swansea. During the next three years, Prestcold intended to acquire the business of their distributors in England and, in their place, create regional marketing units which would, within limits, be autonomous in their operation. A number of these businesses had already been purchased and negotiations were being carried out for others.

These marketing units would operate under the control of a regional manager and his staff who would undertake responsibility for the selling of commercial and industrial refrigeration equipment, together with the distribution of domestic refrigerators and any other appliances which would be manufactured by Prestcold. In addition, complete service facilities will be available in each region.

Commenting on the factory at Swansea, Mr. Field said that it was first brought into production last March at a cost of £5,000,000 and was equipped with the finest plant that money can buy. Although it would be some months before it is in full production, already finished goods were beginning to flow from the production lines. These were of the highest possible quality and design, he said. In due course the factory would make not only commercial and domestic refrigerators, but also other appliances.

PICTURE OF THE MONTH

Whirlpool Corporation in the United States has recently developed an entirely new type, remote-control room air-conditioner. It is a well-designed unit with brushed-chrome control panel which can be placed anywhere within easy reach and enables the user to adjust cooling or heating temperatures, air direction and volume, and exhaust without leaving chair or bed. The unit can be installed in the bottom of windows, currently the customary location, or, for the first time, conveniently at the top. In no event is it necessary to go near the unit except to inspect or change the filter. Truer room temperature control is provided by placement of the thermostat inside the remote-control panel rather than in the air-conditioner. This means that temperature is now controlled from where the user is located rather than where the air-conditioner is installed. At the front of the cooler, two sets of louvres are employed to direct air flow. Three signal lights located left of the louvres indicate at a glance when the unit is turned on (red); when it is cooling (blue); and when stale air is being exhausted from the room (white).

Turkeys by the million !

Interior of 8,000 bird growing unit on Weston Airfield; there are ten of these houses.

Immersion Freezing – the Heart of the Oven-Ready Trade

THE spectacular growth of the turkey industry in Great Britain has been achieved by the determination of the leading members of that trade to provide the public with an article of food right in line with contemporary trends. Quick-freezing has proved to be the means by which this commodity can be brought into the average home at a reasonable price.

If the over-all growth of the industry has been spectacular then the emergence of Mr. Bernard Matthews as the largest producer in this country has been a breathtaking success story.

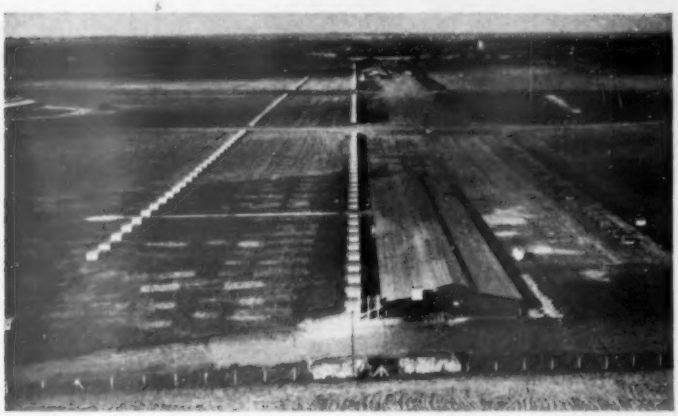
The size and price of turkeys reared and processed by traditional methods have in the past largely restricted turkey eating in this country to Christmas dinner, most authorities will agree. Now Mr. Bernard Matthews, who began in business 10 years ago at the age of 20, with a capital of 50s., is starting a revolution in turkey eating. Two things make possible the Bernard Matthews turkey. Scientific breeding on the largest turkey farm (300 acres) in Europe, plus production-line processing in a new automatic plant capable of handling 500 turkeys an hour. In 1961, a new smaller kind of turkey—only 5 to 7 lb. (trussed weight)—will rival other poultry or red meat for the week-end table, for turkeys have a higher proportion of edible meat than other kinds of poultry. There will also be half-turkeys, oven ready, weighing about 3 lb., so that turkey can take its place in the daily family menus.

"M.R." inspected last month, at Great Witchingham Hall, the completely new Matthews processing plant, probably the most modern in Europe. It is designed to handle 500 turkeys per hour, and the plant, which was supplied by Barker-Maywick, is a revolutionary system which has enjoyed tremendous success in the U.S.A. prior to its introduction to this country.

The birds are unloaded from lorries and placed on a conveyor line suspended by their legs on auto-trip shackles as they enter the factory. They pass through an electric stunner; the electric shock stuns the birds

Great Witchingham Hall, headquarters of Britain's largest turkey producer.

Aerial view of two miles of breeding units at Bernard Matthews Ltd.'s at Weston Aerodrome.



prior to their being killed. The birds then pass through the bleeding tunnel and are lowered into the Barker-Maywick turn-round scalder. This scalds the turkeys in water controlled at the correct temperature by a thermostat. Propellers driven by motors create a cascade effect at each side of the scalder to ensure complete immersion.

From the scalder, the birds pass on the conveyor line through the quaintly named garter machine. This removes all the feathers round the hocks by means of short rubber fingers and the birds pass on to the Barker-Maywick cyclomation plucker. This is the most revolutionary item in the whole range. When the turkeys reach a point above the loading platform, the auto-trip shackles are opened by a device located on the conveyor track. The birds drop on to a conveyor platform and when the weight of birds reaches between 70 and 90 lb. the synchronized conveyor moves and tumbles the birds on to the drum of the plucker. In the drum is another drum from which projects a spiral of short rubber fingers; this revolves at high speed and quickly but gently removes all the feathers.

When the operation is complete, the door in the side of the drum opens automatically and the carcase is passed on to another conveyor which carries it to the re-hang table. In the meantime, jets of water round the rim of the drum wash down all feathers on to the feather conveyor, which takes them out of the building. The bird's feet and tendons are removed in a Barker-Maywick tendon puller before being re-hung on the eviscerating line. They then pass automatically on to the neck and wing machine which removes all the remaining feathers on the wing tips and shoulder area.

The birds are inspected as they pass on the conveyor line into the eviscerating department. The evisceration is done by women working at a stainless steel trough, each person doing one operation as the turkeys pass by at a controlled speed. The offal is put in the main trough and water-conveyed out of the building. The giblets are placed in a stainless flume under the troughing and are conveyed by water to the giblet wrapping table. Here the water is driven off as a device lifts them on to a plastic belt running the length of the table. The giblets are then packed prior to chilling.

As the birds continue along the eviscerating process, the electric gizzard skinner pulls away the gizzard skin after the gravel has been washed away by the spray. Along the troughing are a series of plain and spray nozzles. An interesting feature of this equipment is that the water is conveyed and extruded through a closed channel in the rim of the trough. This obviates expensive plumbing. At the end of the line a combination washer thoroughly washes the birds inside and out before they are removed for chilling.

At this point the birds leave the Barker-Maywick processing plant and in order to maintain the high quality right up to the point of sale, careful control of freezing and refrigerated storage conditions is of the utmost importance. So before being wrapped the turkeys are chilled in iced-water tanks in which ice in the form of dry flakes is used. This has a much greater surface area than any other forms and can therefore absorb heat quicker, thus obtaining a very high rate of chilling. The flake-ice machine, which was installed by J. & E. Hall Ltd., as indeed was all the refrigeration plant, is capable of producing 4 tons of flake ice every 24 hours. This machine is refrigerated by a 4-cylinder Hallmark vee-bloc compressor, driven by a 22½-horse-power slipring motor, and is mounted on an insulated storage bunker lined inside and out with galvanized steel. The flake ice is harvested through two ice doors at the bottom of the bunker being discharged directly into portable chilling tanks. The storage bunker will hold up to 3 tons of ice,

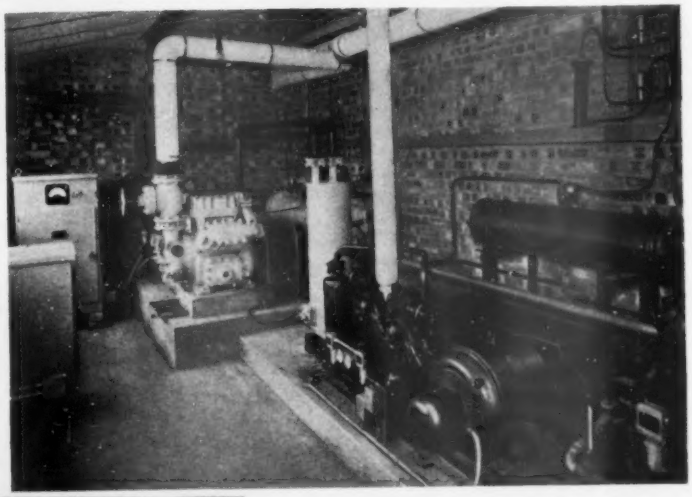
View of eviscerating line.

"Arrival" end of the immersion freezing tank.

so the flake ice machine is able to produce every night ready for use the next day. There is an automatically controlled device which stops the machine when the bunker is full.

After chilling, the turkeys are wrapped individually in plastic Cryovac bags. All the air is drawn from the bags by a vacuum pump. The bag is sealed and the wrapped bird is then dipped into hot water to shrink the bag to a skin-tight fit. The wrapped turkeys are then placed in an immersion freezer which was especially designed and installed by J. & E. Hall to handle the very large quantities of turkeys which Bernard Matthews Ltd. are producing, refrigerated by a six-cylinder Hallmark vee-bloc compressor. The tank is approximately 33 ft. long and 6 ft. 6 in. wide and 3 ft. deep and contains brine which is maintained at a temperature of $-6°$ to $-10°$ F. The turkeys are held below the surface and carried along at a pre-determined speed by a special wood slat conveyor manufactured from materials specially chosen for their resistance to corrosion. This plant is capable of a 75 per cent. freeze of up to 300 10-lb. turkeys every hour. On removal from the freeze, each bird is rinsed and then carefully packed in paper and wood shavings in cardboard carrying containers.

The packed birds are then stored in a sub-zero storage chamber with a capacity of 11,500 c.ft. which is maintained at a temperature of $0°$ to $-5°$ F. by the Hallmark refrigeration machine. The refrigeration capacity is such that while maintaining the sub-zero storage temperature



Above: Refrigerating machinery room.
Left: Sub-zero store.

in the chamber, it will at the same time remove the remaining 25 per cent. of the latent heat in completing the freezing of the birds which have just been removed from the immersion freezer.

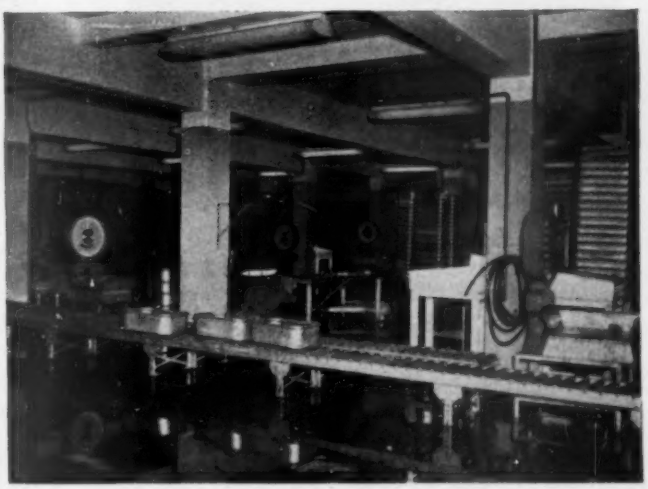
Two super freezing type doors provide access to the chamber and the turkeys enter the chamber through the loading hatch fitted with a rubber curtain at the hatch and entrance and fitted with low-voltage electric gaskets. The gaskets operate through the transformer off the mains and are controlled by thermostats to prevent the possibility of the doors sticking shut by the formation of ice on the sealing gaskets.

ICE-MAKING AND STORAGE AT NEW FISH DEPOT

MAC FISHERIES RE-BUILD AT FINSBURY PARK

A "TRAWLER-to-table-within-24-hours" service, which will speed delivery of fish to shops all over Greater London, was put into action recently by Mac Fisheries Ltd. at a new depot at Finsbury Park, London. Serviced by a railway siding able to accommodate 18 fish wagons at a time, the centre is connected by direct rail link with Scottish, Humber and other fishing ports. As many as five special fish trains from various ports may arrive during the night, until 5 a.m. Between 50 and 60 tons of fresh fish are unloaded each morning. The centre will distribute this fish, landed the previous day, to over 200 Mac Fisheries' shops so that it is on sale within 24 hours of landing. A total of upwards of 90 tons of fresh foods will be handled daily in different departments of the 27,820-sq. ft. depot.

Ice from the Rapid Ice plant at the new Finsbury depot is kept in storage and used as required. It is fed into the top of the chute on the left of this illustration; the chute incorporates an ice crusher which produces chips of about 2 in. thickness. These are delivered into the trolleys shown for despatch to the various parts of the depot where ice is needed, all of which are on one floor to simplify the movement of fish, etc. On the right in the illustration is one of the sorting lines where incoming fish is re-iced and prepared for delivery to the branches.



Transport

Approximately half of the fish from special trains is transferred immediately to waiting vans in bulk orders. The remainder of unloaded fish is broken down into small lots in the main distribution floor.

Here shop orders are assembled in aluminium containers, which are moved from one scalesman to the next, on a moving conveyor belt system. Each scale adds its contribution—plaice, halibut, etc.—to the order until completion.

Last phase of the journey from the ports is an early morning delivery service operated from the centre by some 30 vehicles. Each serves from 7 to 10 shops, travels on average 80 miles each day. Shops up to 50 miles around London receive supplies from the centre and others even farther afield will be served in the near future.

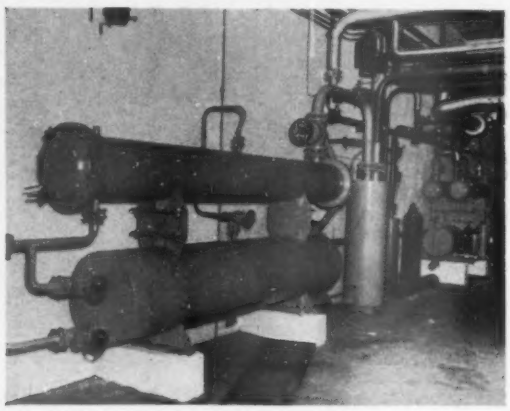
The Rapid Ice plant has a capacity of 10 tons per day, with provision for additional rows of moulds to be added in the future.

Handling and Hygiene

On arrival at the centre all fish is inspected by the quality control organization for condition and appearance. Before return to the coast, metal containers are steam cleaned to ensure complete cleanliness before use. All fish is iced before dispatch to branches.

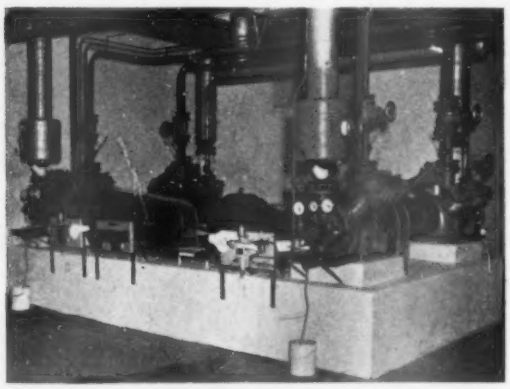
An 8,500-c.ft. low-temperature store, which is used for holding stocks of certain commodities which are not turned out to the company's branches immediately on arrival, was provided with insulation by the Armstrong Cork Company Ltd. It is designed to be maintained at a temperature of -20° F. Refrigeration plant for all low-temperature installations at the centre was provided by J. & E. Hall Ltd. Plant for the store comprises a 3¾ in. by 3 in. four-cylinder compressor and incorporates hot gas defrosting and direct expansion gilled grids.

A smaller chamber of 6,500 c.ft. capacity is used for very short-term storage, being designed for a temperature of 34° F.



Shell and tube condensers are incorporated in the plant for the 8,500 c.ft. low temperature store.

Ice for the depot is produced by a rapid-ice plant on the roof, incorporating two 3¾ in. by 3 in. six-cylinder V-bloc compressors, operating on Refrigerant 12, it has a capacity of 10 tons of ice per day, in 1-cwt. blocks. The 20 standard moulds are arranged in five rows of four, with space for two additional rows in the future, to make the capacity 14 tons.



Four 3¾ in. by 3 in. four-cylinder compressors by J. & E. Hall Ltd. are used to cool the main chamber at the depot. This is designed to be maintained at a temperature of −20 °F.

Ice from this plant is stored in an 800-c.ft. chamber alongside.

Ice is taken from this store as required and is fed into a crushing machine. A chute then feeds it directly into the sorting area below.

Ship built solely for Frozen Food Transport

M.S. "POLAR REEFER"

TECHNICAL SPECIFICATION

Yard : Sölvesborgs Varvs & Rederi AB., Söevesborg, Sweden.

Class : Lloyd's + 100.A.1. R.M.C. Strengthened for navigation in ice. Built according to Swedish Ship Inspection's Rules for ocean and tropical trading and also in compliance with British Factory Act's and U.S. Coast Guards' rules and requirements.

Dimensions : length over all ... 204 ft.
beam ... ... 32 ft. 10 in.
draft summer freeboard 125 ft. 1½ in.
d.w.a.t. „ „ 804 long tons

Cubic capacity for frozen refrigerated cargoes ... ... 49,900 c.ft.

Pallet capacity 820 × 1,220 × 1,250 mm. about 700

Minimum height lower holds... ... 1·90 m.
„ „ shelter deck ... 2·70 m.

G.R.T./N.R.T. : 499 tons resp. 232 tons.

Hatches : 3 : weatherdeck 3·24 m × 3·14 m., main deck 3·60 m. × 3·50 m., all of steel main deck hatches flush.

Derricks : 6 : all 12 m. long, 3 tons.

Winches : 6 : all 3 tons hydraulic, speed 50 m./min. with 1½ tons lifts, two winches for each hatch operated by one winch driver from the hatchcoaming.

Service speed : about 13 knots fully loaded.

Passengers : 2 in double cabin.

Nautical equipment : radar, gyro, autopilot, echo sounder, bridge manoeuvres, etc.

Machinery : Swedish " Nohab-Polar " engine, Type MN15 two-stroke single-acting marine diesel 1,315 i.h.p., 1,050 b.h.p., 335 r.p.m.

Consumption : about 13 knots on about 3·5 tons marine diesel oil ; about 12 knots on about 3·0 tons marine diesel oil.

Auxiliaries : 3 Penta/A.S.E.A. total output 315 kVA· 440/110 volt A.C. 60 periods.

Consumption : about 0·2/0·5 tons gas oil.

Insulation : Frigolit (average K-value not above 0·45 kcal/h m²).

Air changes : 75 or 37 times per hour.

Freezing capacity : −27° C. by + 40° C. air temperature and +20° C. water temperature.

Refrigerant : " Freon-22."

Manufacturers of refrigerating machinery : STAL, Norrköping.

Compressors : 3—3-cyl. type PV538.

Output of compressors by 500 r.p.m. and +30° C. condensing temperature :
3 × 170,000 = 510,000 kcal./h with 0° C. evaporating temperature.
3 × 91,000 = 273,000 kcal./h. with −15° C. evaporating temperature.
3 × 31,000 = 93,000 kcal./h. with −35° C. evaporatting temperature.

Thermometers : 8 measuring points in the holds with reading possibilities on the bridge and in the engine room.

Airchanges : Vertical upwards.

The holds are suitable for fork trucks cargo handling.

3 fork tricks with a capacity of about 2 tons each are carried on board.

3 crane trucks are carried on board.

IMPORTANT progress in marine refrigeration was celebrated recently when the *Polar Reefer*, the first ship in Europe, and possibly in the world, to be built solely for the transport and palletized handling of quick-frozen foods, was welcomed by the Mayor of Grimsby. Its main function will be to provide a regular service for bringing the products of the Findus factory at Bjuve from Halsingborg to Grimsby.

From the aspects of mechanical handling, insulation, and refrigeration, the *Polar Reefer* creates many new precedents, and is well worthy of the close study of all who are concerned with the movement of quick-frozen foods by sea.

The cargo, in the form of fibre-board cases of frozen food, is brought from the Halsingborg cold store to the dockside, loaded, stacked on board, unloaded, and transported to the Swedish-owned cold store at Grimsby, stacked all the time on post pallets. This palletized movement involves the use of a two-pronged fork in place of the normal hook for loading and unloading ; while, forming part of the equipment of the ship, are three fork-lift trucks with their own housing on deck—including electric plant for charging their batteries. These trucks are used for moving and stacking the palletized cargo within the four holds.

Polar Reefer is the first cargo ship to have a Lloyd's certificate for such a low temperature as −27° C. (−17° F.), and using " Freon 22." This cooling medium is necessary in order to guarantee this temperature with a safe margin. Other refrigerated ships, the owners of *Polar Reefer* tell "M.R." are mostly using " Freon 12," with certificates mostly for −35° C.

The vessel is also, so far as its owners are aware, the first to be insulated with Frigolit, which, being a thin, compact material, has made it possible to provide appreciably more cargo space (the estimated increase is from 5 to 7 per cent.).

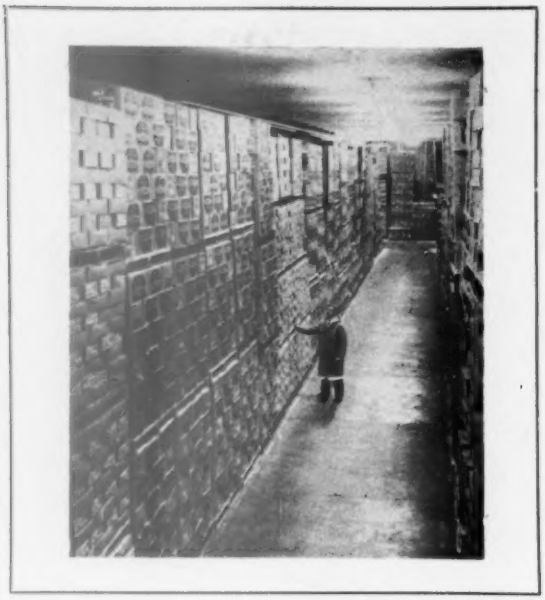
Looking at the output of the compressors, it would seem that the vessel has considerable reserves when running normally. A noteworthy fact is that the air changes in the holds are vertically upwards (37 or 75 times an hour) and this obviates air pockets which might otherwise adversely affect the cargo.

Considerable time is saved, and the risk of damage to cargo minimised in loading and unloading, by the fact that, instead of handling what would normally be from 60,000 to 90,000 cases, the fork-lift pallet system reduces the handling to about 700 pallets. Another advantage is that the time during which the frozen foods are not under properly controlled temperature is reduced by two-thirds because of the much more speedy transfer from lorry to ship and ship to lorry.

The owners of the ship—Rederi A.B. Polar, of Brunby, Sweden—point out that, with the conventional and normally slow loading and discharging system, a substantial rise in the temperature of the products is inevitable. With the *Polar Reefer's* method of operation, they do not get the opportunity to rise more than two or three degrees.

The ship has a deadweight of 850 tons and is 198 ft. long and 33 ft. wide. The total low-temperature cold-storage area is 53,000 c.ft.

The Philco Corporation, Philadelphia, whose manufactures range from refrigerators to electronic gear for earth satellites, intends to expand operations on the German market. Philco president Harvey Williams stated recently that the company will increase investments and expand output capacities in the countries of the European Common Market. The initial programme for West Germany includes the sale of refrigerators, washing machines and driers, to be expanded later to comprise TV and radio sets. The corporation currently has subsidiaries in Switzerland and in Italy.



Europe's LARGEST Frozen Food Store

TWO new frozen food stores with a combined capacity of 9,000 tons have been added to the existing 4,000-ton Birds Eye cold store at Lowestoft, opened by the Postmaster-General in September, 1958. The extensions were opened officially on October 4 by Mrs. A. D. Bonham Carter. They bring the total capacity up to 13,000 tons which, states the company, is the largest single unit of frozen food cold storage space outside the U.S. The two new chambers are of 4,000 tons and 5,000 tons capacity respectively and are connected to each other so that they form one single chamber. The entire capacity is 1,790,000 c.ft.

Work started on the new extensions on January 4th, 1960. As the site on which the cold store stands was 2 ft. under water during the 1953 floods it was decided in 1958 that the original store and engine room should be built at a floor height of 4 ft. above ground—*i.e.* at vehicle loading height—and that there should also be a 3 ft. high water-proofed 9 in. brick wall with metal flood gates at access points. The same problems were considered in constructing the new chambers.

Foundations take the form of 9 in. brick sleeper walls at about 9 ft. centres, set in concrete and topped by precast reinforced concrete beams on which the cold stores are built. Because of the open nature of the foundations no heating mattresses are required.

General Construction

Erection of the steel work began on February 22 and on February 29 work began on the addition of 5-in.-thick prefabricated sections of expanded polystyrene. Further 2- by 1½-in. slabs were applied on site, the whole being fully vapour proofed. The floor, which is 10-in. cork slab, was also applied on site. The outer cladding of the store is aluminium, behind which are 4-in. slabs of " Melcrete " which provide four hours' fire resistance. The roof is made from Big Six asbestos sheeting.

The stores are contained with a steel framed structure with 5° trusses capable of taking the load of ceiling and refrigeration coils. Floors are 3-in. granolithic cement, coloured in the gangways and painted with the entire pallet layout.

The main entrance contains a manually-operated super-freeze sliding door, supplemented by an air curtain and a double leaf polyurethane curtain. This is a new development by the company and its purpose is to allow the door to stay open during any working period.

Refrigeration

The condensers are situated on the roof above the engine room and are hidden from the public highway by the store itself. The new ammonia compressor equipment includes two 250 h.p. V-bloc compressors and two 150 h.p. boosters. The second set is a complete standby. The duty of one set is to attain and maintain a temperature of –20° F., although –5° F. will be the normal operating temperature. The two stores contain 19,000 ft. of finned coils.

Control of the equipment is automatic through a controller in the engine room which also indicates and records the average temperature in the store. Should the temperature rise above –2° F. an alarm bell and warning light are set into operation.

To ensure that there is no wastage of space above the area in which cases from the casing room are palletised, a mezzanine floor has been installed at this point. This is used to stack the inevitable small items, such as quality control samples and incomplete cases.

Architect for the store was A. T. Wright, A.R.I.B.A., and detailed design and construction of general structure and insulation was by Smiths Insulations Ltd. Refrigeration was provided by J. & E. Hall Ltd.

Birds Eye cold storage capacity at Lowestoft now totals 13,000 tons, capable of holding something over 60,000,000 cartons of quick-frozen food.

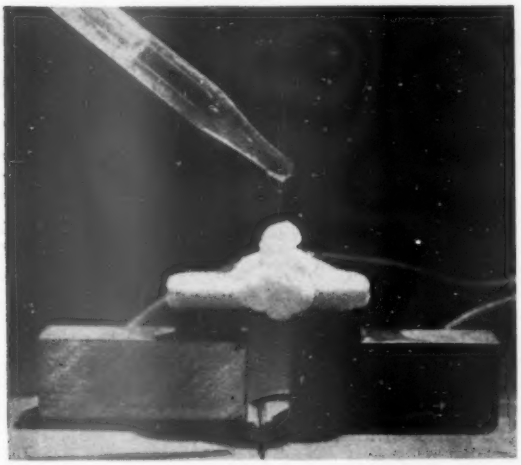
Greatly increased production by Birds Eye is the reason for the additional chambers. Industry sales will exceed £50,000,000 this year and in five years time are expected to be more than twice that figure. Birds Eye's share of this market is in the region of 70 per cent.

The Lowestoft factory is one of five owned by this company—the others are at Yarmouth, Grimsby, Liverpool and Eastbourne—and is mainly concerned with the production of vegetables, fish, fruit and pastry products. It employs well over 1,500 people at the height of the season.

THERMOELECTRIC REFRIGERATION

NUCLEAR research scientists working in the Atomic Power Department of Westinghouse Electric Corporation in the United States have recently developed a line of special materials that can produce thermoelectric refrigeration. The accompanying illustration shows the demonstration of the principle of the new type refrigerating method when direct current is applied to a junction of two semiconductor materials (two black cylinders just below ice formation).

The temperature at the junction is low enough to freeze water from an eye dropper. If the current was reversed, thermoelectric heating would be substituted for the cooling effect. Using the thermoelectric principle, the company has already built several experimental appliances including a full-scale thermoelectric refrigerator which operates without the aid of a conventional refrigeration system.



Demonstrating the principle of " thermoelectric refrigeration."

NEW TRICITY REFRIGERATOR

A new refrigerator, the " Diner-cold," has been launched by Tricity. The " Diner-cold " which has a wooden cabinet in sapele veneer adds grace to any part of the home, says the manufacturer ; when closed it is quite indistinguishable from any normal piece of lounge or dining-room furniture.

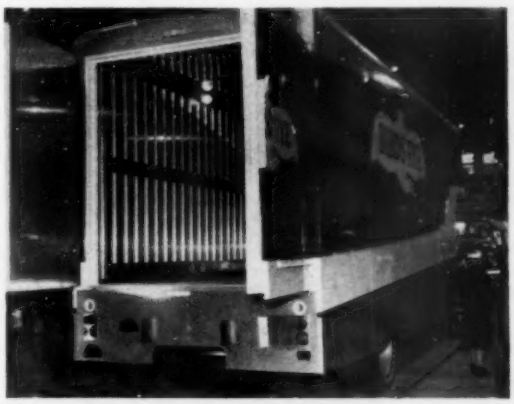
The " Diner-cold " in addition to its unusual external appearance has four rubber wheels allowing movement for cleaning, a compressor-type refrigeration unit guaranteed for 5 years, a freezing compartment with a spring loaded door and a salad drawer with combined glass lid and shelf. Gross capacity is 4·5 c.ft. and its external measurements are 36 in. high, 22½ in. wide, 25 in. deep. The door interior will hold an ample supply of milk, wine or cordial and a tuck-away egg rack is provided. The interior finish is of easy-to-clean high impact polystyrene and an interior light is fitted. Average current consumption is 1 unit per day. Price of the " Diner-cold " is 72 guineas.

The new " Diner-cold."

REFRIGERATION AT "COMMERCIAL MOTOR"

PROGRESS in the field of refrigerated vehicle design during the past year was reflected at the recent Commercial Motor Show, which was held at Earls Court, London, from September 23 to October 1.

Four items were shown on the stand of Mann Egerton & Co. Ltd., of Norwich, one of which, a refrigerated box van body, mounted on a forward control 2-ton Austin chassis, aroused considerable interest. Decorated with the markings of the Findus livery, this vehicle has a refrigerated cubic capacity of 270 c.ft. Also on this stand was a 385-c.ft. capacity 4-ton refrigerated Austin van.



Sparshatts' body for Bird's Eye.

The company's ship-borne refrigerated container, featured in the display, is of composite construction with a mild-steel and hardwood framework for strength. It incorporates polystyrene insulation of 6 in. thickness and is fitted with lifting slings. The refrigerator compartment is situated at the top of the container's front bulkhead, with louvred doors to prevent the ingress of sea water.

The well-known Mann Egerton " Unicorn " chassis-less semi-trailer was also shown. Designed for either low temperature work or normal freight carriage this trailer has a length of 25 ft. 6 in. and a height of 12 ft. 2 in.

Ford Thames Trader, 7 ton, 160 in. W.B., 6D van. This long wheel base vehicle has a standard body length of 16 ft. 6 in. A 138 in. W.B. model is also included in the 7-ton range. A completely new braking system is now fitted incorporating Hydrovac constant vacuum serve assistance with an increased lining area of 480 sq. in.

Centrepiece of the stand of Dodge Brothers (Britain) Ltd. was a 1,080-c.ft. refrigerated vehicle carrying the familiar Birds Eye colours. This lorry, the bodywork for which was provided by H. Sparshatt & Sons Ltd., Portsmouth, who build to customers' own specifications, weighs 8 tons.

On their own stand, H. Sparshatt & Sons showed their 360-c.ft. " container-in-body " van mounted on a Thames 3-ton chassis and incorporating a Prestcold 1½-h.p. refrigerating unit ; this vehicle is one of a number which the company has supplied to Smedley's.

Hawker Siddeley (Hamble) Ltd., manufacturers in the U.K. of the Thermo King range of refrigerator units for transport applications, were represented at the show.

These one-piece units are designed for easy installation in a truck or trailer body. Power is supplied by a self-contained internal combustion engine. Certain models are available with combination combustion-electric power or with electric power only. Other models are also available to operate by a hydraulic motor from either the truck engine, or power take-off at the transmission. All parts of the unit are contained in a single frame made of steel and aluminium. The frame is specially designed to withstand the stress of road operation. In the front section (the section that remains outside the truck body) are the engine, compressor, condenser coils and controls. The rear section, which is inserted into the body, contains the cooling coil, circulating fan and automatic control valve.

Control of temperature is fully automatic. The operator adjusts the thermostat to the temperature to be maintained, and then snaps the starter switch. The unit runs until the desired temperature is reached and then stops. When the temperature in the trailer rises a few degrees the unit automatically starts again.

Refrigeration in the truck or trailer is accomplished by " forced convection " that is, air is drawn from the body through the cooling coil where heat is removed. The cooled air is then blown back into the body and over the cargo. The air moves downwards, under and around the lading, and again blows through the cooling coil. On certain models the same mechanical system used for cooling is also used to provide heating; conversion from cooling to heating is made by snapping a switch.

A stand of considerable interest was that of VW Motors Ltd., London, N.W.8, the British company which handles U.K. distribution of the German Volkswagen. The company has recently introduced a new version of its well-known van incorporating a refrigerated body of a size which would recommend it for use on localized wholesaler/retailer distribution or retailer delivery sales for frozen foods.

With a fully insulated storage compartment, this vehicle employs aluminium pipes acting as evaporators. The inside of the insulating layer is clad with aluminium foil. On the side of the storage compartment the insu ating material together with the pipes is covered with aluminium sheet. All joints are specially protected by aluminium slats. No metal contact exists between inner lining and outer panel of the vehicle, thus avoiding any cold exchange to the outside.

The refrigeration unit comprises a piston compressor with two cylinders, a coolant receiver and the drive units. It is powered by the vehicle's engine—when running—or, for stationary operation, by a built-in electric motor which can be plugged to the local power system.

Provision has been made for the safe and convenient operation of the refrigeration unit. The temperature is thermostat controlled. A remote thermometer in the driver's cabin offers an additional control feature. At an ambient of + 50° C. (+ 123° F.) a constant temperature of – 20° C. (– 5° F.) can be maintained in the storage compartment, say the manufacturers.

REPAIRS FOR FLOOD VICTIMS

Electrolux refrigerators, cleaners and floor polishers damaged by flood water in areas of Britain affected by the present flood crisis will be repaired by the Electrolux service organisation at a reduced charge on a non-profit basis, it is announced. Electrolux service managers whose areas are affected by floods have been asked to give priority to the job of reinstating damaged Electrolux appliances as quickly as possible and dealers are being asked to co-operate.

Left: Fig. 1.—The 14-station quick-freezer.

Below: Fig. 2.—Balance valves and hoses exposed by removal of insulated panel.

New Freezing Plant from Warrington

ON test last month at the Billingsgate premises of The London Ice and Cold Storage Co. Ltd. (whereat many historic freezing experiments achieved success pre-war) were to be seen two pieces of equipment developed by The Warrington Tube Company Limited, of Warrington, Lancashire. The plant referred to was a block ice unit and a 14-station quick-freezer.

The quick-freezer, which is shown in fig. 1, incorporates "Warrington" primary surface plates, each of which has a freezing area of 5 ft. 1⅜ in. by 3 ft. 2¾ in. and is rated by the firm as having a "K" factor of 16, which is extremely high.

The freezer has a capacity of 140 lb. per station (*i.e.* a total of 1,960 lb.) and in operation gives the high degree of efficiency which is shown on the performance graph overleaf. It comprises 15 primary surface plates, which are made from specially rolled rectangular solid drawn-steel tube, liquid inlet and gas outlet headers, fine control liquid balance valves and high quality flexible rubber connecting hoses which are positioned at the back of the cabinet and protected with a stop plate.

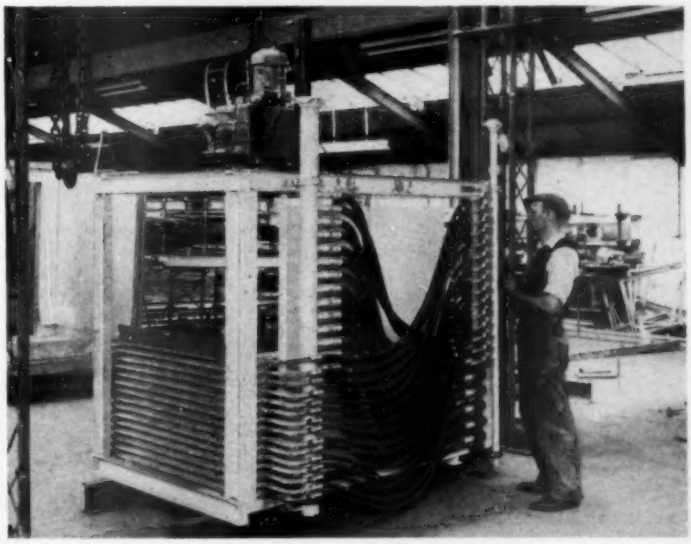
The plate linkage is effected with high tensile bolts and the opening and closing operations are controlled by a very efficient hydraulic unit of "package" design which is mounted on top of the cabinet and provided with an easily accessible "3 position" control lever. In the closed position a positive pressure of 500 lb. is continually applied to the plates so that throughout the freezing cycle constant and complete contact is achieved between produce and plate surfaces.

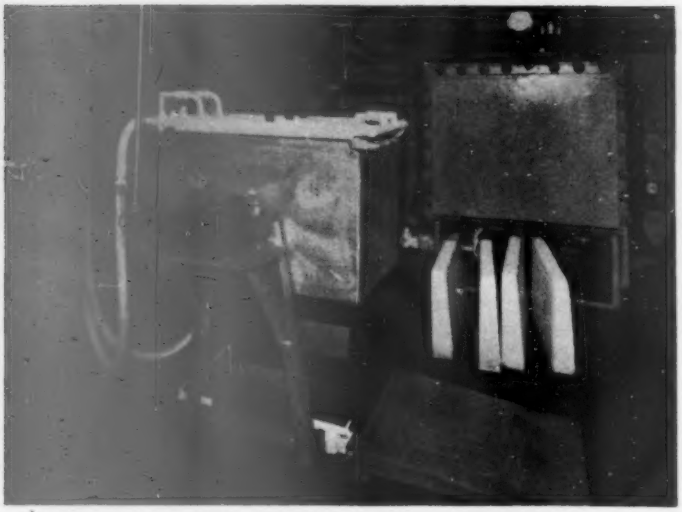
The plates are assembled within a robust steel framework and the whole is of zinc sprayed or galvanized finish. Around the operating equipment there is an independent insulated cabinet formed from 4-in.-thick polystyrene slabs, 20-gauge galvanized internal and external steel sheeting and framed with preservative treated Columbian pine. Super freezer doors are fitted at the front and are lined externally and internally with 20-gauge galvanized steel sheeting. They are complete with white felt gaskets, galvanized hinges and double-action fasteners. A removable insulated panel is provided at the rear for ease of access to the balance valves and hoses, fig. 2, and also included are heavy-gauge galvanized base tray, a slab-cork insulated base and 4-in. hardwood bearers, which are positioned under the cabinet to facilitate free airflow.

The complete freezer occupies the minimum of space, its over-all dimensions being 6 ft. 11 in. long by 6 ft. deep by 6 ft. 5 in. high, over-all height 9 ft. 2 in.

The "Warrington" block ice and freezing unit, fig. 3, is designed to make blocks of ice and for the freezing of fish or other perishables in block form. It comprises a tank which is open at the top and is mounted on a frame, supported on trunnions for rotation about a horizontal axis by means of an electric motor. The tank is constructed from a number of "Warrington" primary surface evaporator plates and so formed as to provide a number of compartments or moulds which are tapered from top to bottom. These compartments are charged with product and refrigerant is circulated through the evaporator plates until such time as freezing is completed. The tank then rotates on its trunnions into an "upside down" position at which time the supply of refrigerant is cut off and a hot defrosting medium circulated through the evaporator plates.

Such defrosting causes the frozen blocks of produce to cease adhering to the walls of the tank and they forthwith fall out under their own weight.

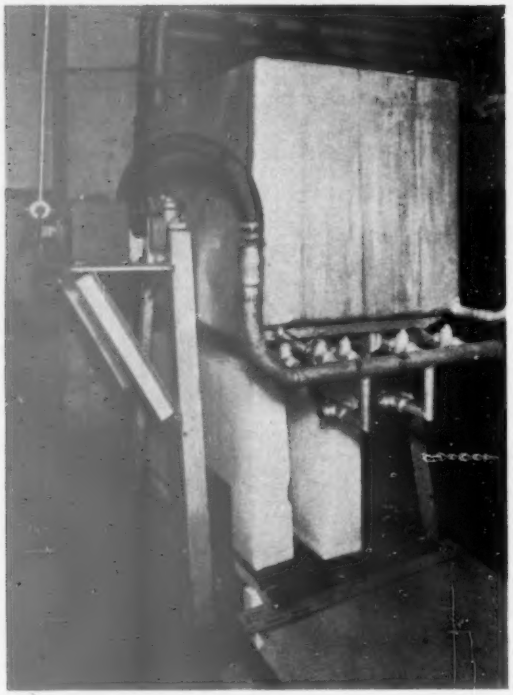




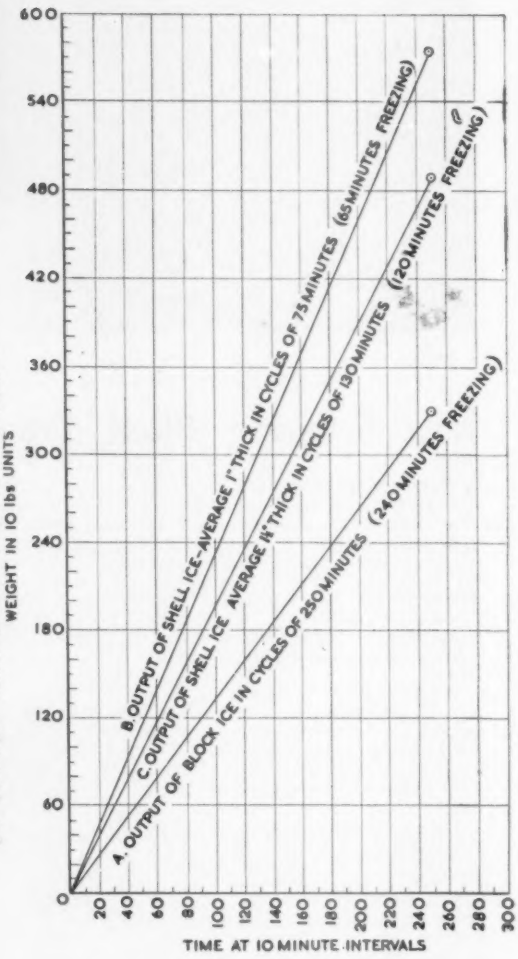
Left: Fig. 3.—The newly-developed block ice and freezing unit with an out-turn of blocks.

Left below: Fig. 4.—Block ice is out-turned by rotation of the tank through 180°.

Below: Fig. 5.—Performance graph of the block ice unit.



Water temperature 64°F. Three moulds working, each holding 11 gallons.
A. Output of solid ice, with timing: 5 minutes for filling, 240 minutes freezing, 5 minutes defrosting. 330 lb. every 250 minute cycle.
B. Output of shell ice, with timing: 5 minutes for filling, 65 minutes for freezing, 5 minutes defrosting. 171 lb. every 75 minute cycle.
C. Output of shell ice, with timing: 5 minutes for filling, 120 minutes freezing, 5 minutes defrosting. 255 lb. every 130 minute cycle.


600
540
480
420
360
300
240
180
120
60
0
WEIGHT IN 10 lbs UNITS
B. OUTPUT OF SHELL ICE-AVERAGE 1" THICK IN CYCLES OF 75 MINUTES (65 MINUTES FREEZING)
C. OUTPUT OF SHELL ICE AVERAGE 1½" THICK IN CYCLES OF 130 MINUTES (120 MINUTES FREEZING)
A. OUTPUT OF BLOCK ICE IN CYCLES OF 250 MINUTES (240 MINUTES FREEZING)
20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
TIME AT 10 MINUTE INTERVALS

All these operations are automatically controlled by means of an electrical circuit which may be arranged for " batch " or " continuous " production.

This electrical circuit energizes a series of relays which in turn governs a number of magnetic control valves, and through the use of a multiple timing device, the sequence of operations is carried out quite automatically and without any need for manual labour.

The refrigerant may be either brine or a direct refrigerant, provided pump circulation is used, and the performance of this unit when employing brine as the refrigerant medium is shown on the accompanying graph, fig. 5.

The units can be made to suit almost any production requirement and typical examples of models available are :—

(1) A single unit comprising up to six moulds.

(2) A twin unit comprising two sets of moulds each set up to six compartments.

As will be seen from the performance graphs, each single compartment can produce up to 1 cwt. of solid block ice or a greatly increased quantity of " shell " ice.

The compactness of the unit should make its appeal to the smaller user of ice or especially where a dual purpose freezer is required—typical examples where it may usefully be employed being, trawlers, small fishing ports, vining stations, small requirement users overseas, especially in hot climates.

PRESTCOLD RESTYLES AND LOWERS PRICES

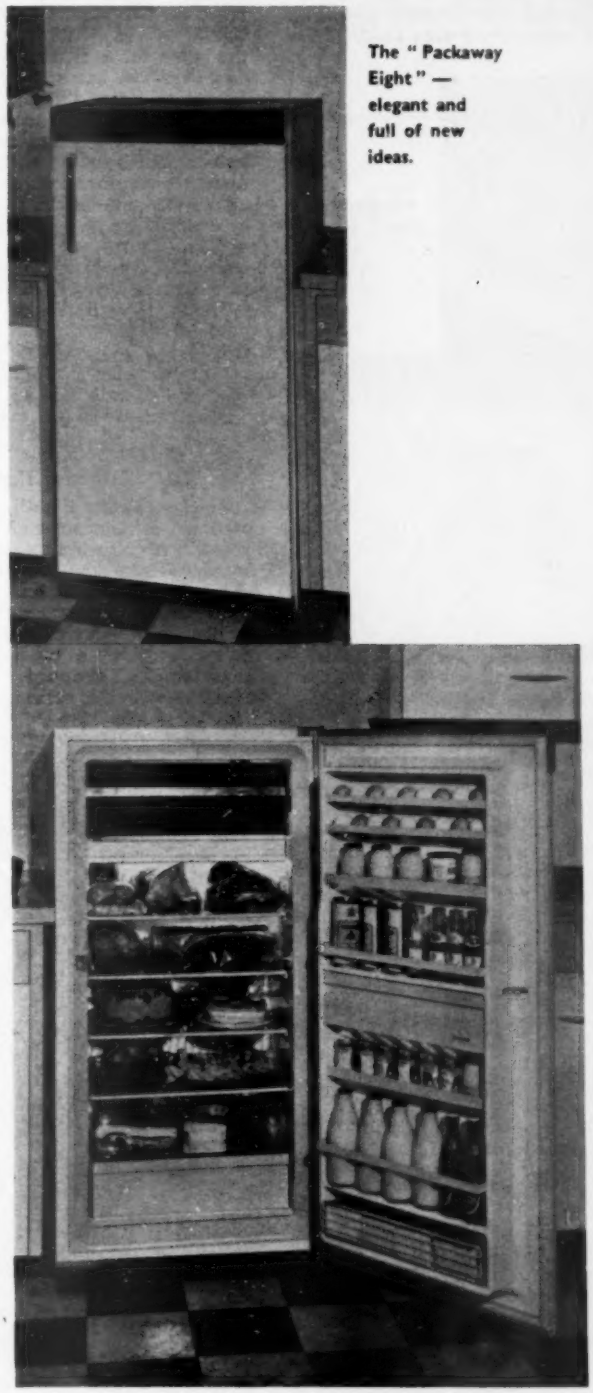
THE outstanding success of Prestcold's 3 c.ft. Packaway domestic refrigerator—winner of the "Design of the Year" award from the Council of Industrial Design and the Duke of Edinburgh's Prize for Elegant Design—has caused this company to base its new 1961 range on this type of contemporary styling. This "rationalization" has not sacrificed individuality but has enabled the three models—3·1 c.ft., 5·2 c.ft. and 8·1 c.ft.—to have a "company character" which is stronger than ever.

Mr. E. G. Rowledge introduces the new models.

Mr. E. G. Rowledge, M.INST.R., director, introduced the 1961 models at The Savoy Hotel, London, last month, and spoke of the great resources at Swansea behind this new production.

The "Packaway Three"

The "Packaway Three" fits even under the draining board (the door opens within the cabinet width); or on a table or working surface. The special wall model, DW.301, will also fit in neatly with most kitchen units. (model DB.302 is made for



The "Packaway Eight"—elegant and full of new ideas.

specified kitchen units.) With its increased shelf area, even this small Packaway will hold a week's supply for a small family. It has three full-depth shelves, a drop-down shelf, a chill tray for meat and fish, and a freezer for frozen food. The

The "Packaway Five."

door is a store in itself, with a full-width dairy bar, racks to hold 12 eggs, and a big space for bottles. Magnetic door-seal. The "Three" has a 27-cube ice tray, holds 8½ lb. of frozen food and offers a choice of left or right-hand door. Other features include a new Econometer sealed unit which runs for about a penny a day, and automatic temperature control. Cabinet colours: star white or imperial cream. Tray top as an optional extra—choice of three colours.

	Height in.	Width in.	Depth in.
Outside:	33½	20⅞	19¼
Inside:	27	17⅜	12⅞

Gross capacity: 3·1 cu. ft.
Shelf area: 5·7 sq. ft.
Cash price—50 gns. (£52 10s.).
The wall model costs 49 gns. (£51 9s.)

The "Packaway Five"

The "Packaway Five" (5·2 cu. ft. capacity) has a large shelf area with its four full-width shelves—the bottom shelf being the cover of a large salad crispator; a large-capacity chill tray, a freezer for frozen food, and an ice tray. The door opens within cabinet width and has many new features. There are three removable racks in it to hold 15 eggs. A sundries shelf for small packages. A full-width dairy bar which tilts forward and can be removed for cleaning. And shelf room for five pints of milk, or four bottles of wine. When one swings the door to, a silent and efficient magnetic seal keeps it firmly shut. It stores 12·6 lb. of packaged frozen food. Ice tray holds 33 cubes. The new Econometer sealed unit ensures low running costs. Automatic temperature control. Interior light. Cabinet colours: star white or imperial cream. Work-top as an optional extra—choice of three colours. On invisible wheels at rear to make it easy to move.

	Height in.	Width in.	Depth in.
Outside:	34⅞	23⅞	25 ⅞

Gross capacity: 5·2 cu. ft.
Shelf area: 11 sq. ft.
Cash price—66 gns. (£69 6s.)

The "Packaway Eight"

The "Packaway Eight" (8·1 cu. ft capacity) is compact and elegant—yet with large shelf area and storage space. There are four full-width shelves in ice-blue and a salad crispator which forms a fifth shelf. A large full-width chill tray for meat and fish; and a big freezer for frozen food. The door is full of new ideas. Removable racks for 18 eggs,

The "Packaway Three."

and two removable shelves for odds and ends like small bottles and packages. A full-width dairy bar, and a main bottle storage shelf that holds five one-pint milk bottles or four one-litre wine bottles. And a removable ice-blue wire basket to hold sundries or fruit. The "Eight" stores 20·8 lb. of frozen food. The two ice trays hold 33 cubes each. Automatic temperature control. Interior light. Cabinet colours: star white or imperial cream. Mounted on wheels at front and rear, with level adjustments and braking device.

	Height in.	Width in.	Depth in.
Outside:	53½	26	25½

Gross capacity: 8·1 c.ft.
Shelf area: 15·3 sq. ft.
Cash price—89 gns. (£93 9s.)

From **Prestcold's** mammoth new factory at Swansea comes a story of confidence and high hopes for the future. Last month a series of annual sales conferences, presided over by sales director, Mr. D. A. Field, was staged there. Distributors, marketing managers and scores of executives from all parts of the nation-wide Prestcold sales network attended the conferences. A spokesman commented afterwards that the meetings were a huge success and that, in spite of the present Government squeeze, sales were expected to expand during the forthcoming year. "Confidence is extremely high," he said. "The new models—based on the famous Prestcold 'Packaway' award winning design—will attract large markets at home and overseas." Delegates were shown details of an ambitious programme for the coming year dealing with advertising, publicity, sales aids and special promotions. The conferences were the first ever held at Swansea and, for many salesmen, they provided a chance to tour the new factory which is one of the largest and most highly mechanised of its type in Europe. It came into first production last March and, within the foreseeable future, will be capable of producing up to 6,000 refrigerators a week.

* * *

"Domestics" in Sudan.—A new licensee for the manufacture of household refrigerators in Sudan has been signed by Kelvinator International Corporation, according to an announcement by G. T. Etheridge, vice president of the American Motors subsidiary. Coldair Engineering Company, leading manufacturer of room air-conditioners in Sudan and former distributor of Kelvinator International's Leonard

brand appliances, is the new manufacturing licensee, with headquarters and plant at Khartoum. Owner and president of Coldair is V. Christoforou. A new building, about 12 miles from Khartoum is nearly completed and will house the combined manufacture of room air-conditioners and refrigerators. During the first year of operation, the company will assemble refrigerator cabinet components and refrigeration systems which will be shipped from the Bromborough plant of Kelvinator, Ltd., of England," Etheridge said. Coldair will assemble and finish the refrigerators and gradually increase the manufacture of components so that only refrigeration systems will be imported.

FRIGIDAIRE MODELS FOR 1961

The new "SheerLook" Range

FRIGIDAIRE Division of General Motors Limited announce the introduction of a new range of domestic refrigerators, superseding their three and four c.ft. 1960 models. The range is in a completely new style, entitled the "SheerLook," with slim, upright cabinets designed to take up the minimum kitchen floor space while providing maximum food storage and freezer capacity.

The "SheerLook" models are in three new sizes, 2·9, 3·8 and 5·1 c.ft. respectively, recent surveys conducted by Frigidaire having shown that these are the sizes now most needed in Britain. Cabinets are squared-up, with doors recessed into the outer shell and gently "sculptured" to give a curving face in relief to the straight edges. Exterior decoration is simple, confined to a slim handle and the blue Frigidaire nameplate, but internally a new patio filigree tracery pattern in white on blue enhances the appearance of doors to the freezer and dairy compartments.

The price of the DB-50 is 69 gns. including purchase tax, that of the MB-40T is 59 gns., and of the MB-30, 49 gns.

The larger Frigidaire domestic refrigerators are retained in their existing form, with the deletion of the 9·9 c.ft. model in "Master" form. This range, therefore, now comprises the "Master" model MZ-84, of 8·3 c.ft. capacity, and the "De Luxe" models DZ-84 and DZ-101, of 8·4 c.ft. and 10·1 c.ft. capacity respectively, each with 46½ lb. super-freezer chests for long-term storage of frozen food and for home freezing. Prices of the larger

The 5.1 c.ft. Frigidaire, DB-50.

The 3.8 c.ft. model, MB-40T.

models remain as at present, namely : Model MZ-84, 113 gns. ; model DZ-84, 125 gns. ; model DZ-101, 158 gns., all prices inclusive of purchase tax.

Frigidaire's model MB-30 of 2.9 c.ft.

KELVINATOR'S 1961 SERIES

At Grosvenor House, London, on the 9th instant, The Countess of Listowel introduced Kelvinator's surprise refrigerator of the year called Lady K. This is claimed to be the first 3 c.ft. refrigerator to keep frozen foods and ice-cream in the freezer in perfect condition for up to *three months*. Its main dimensions are 19—34⅞—19. Only 19 in. wide, 34⅞ in. high and 19 in. deep ; Shelf space is over 5 sq. ft.

This "Zero-Plus" freezer is also incorporated in Kelvinator's improved 4·6 c.ft. refrigerator, K46ZP. So every Kelvinator now has a "Zero-Plus" to keep frozen foods and ice-cream perfectly fresh for three months or more.

Another advance in this new family-size model is the increase in shelf area—from 7¾ sq. ft. to 8·4 sq. ft.

Ten other star points are listed as :—

Working table-top in heat and stain resisting, non-chip Warerite.
Chill tray to keep meat and fish colder than in main food storage.
Moisture-seal crisper for dawn-dewy crisp salads, fruit, vegetables.
Separated butter and cheese storage.
Dairy compartment and egg rack on door.
Slide-out shelving buffered with resilient white plastic.
Tall bottle storage on door.

Kelvinator's new "Lady K."

Automatic interior light.
Adjustable glider feet for easy movement and levelling.
Door opens within cabinet width.
Main dimensions are :—22 $\frac{13}{16}$ in. — 34 $\frac{11}{16}$ in. — 25$\frac{7}{8}$ in. (height, width and depth).

With the inclusion of this freezer in the new 3 c.ft. Lady K and the improved 4·6 c.ft. models, Kelvinator can now offer the "Zero-Plus" chest in their complete 1961 range from 3 c.ft. to 9·4 c.ft. The individual capacities are 3·1, 4·6, 6, 7·7 and 9·4 c.ft.

Prices of the two new models are :—Lady K, 50 gns. ; K46ZP, £70 7s. 0d.

Kelvinator's new 4.6 c.ft. model.

SHOP REFRIGERATION NEWS

Refrigeration helps these Personally Owned and Operated Businesses to Success—

By Our Special Correspondent

INDIVIDUALITY *PLUS* CHARACTER

WITHOUT posing as a champion of the small food retailer (the kind that I meet don't need one), variously described as downtrodden, depressed, demoralized by, and disappearing as a result of, the advance of the supermarkets and multiples, I am concentrating all my attention this month on shops of that type. And it so happens that I have been looking rather more intently at those belonging to butchers.

Known generally as independents, though I prefer to describe them as individually owned and operated businesses, they are diminishing in number but developing in character. And the development of that distinctive appearance and high reputation is being fostered and encouraged by the makers of refrigerated cabinets and cold rooms.

That last statement is of the sort that would be made by a public relations expert for the British refrigeration industry, and from such a source it might be suspect, as mere propaganda. Without any kind of axe to grind, views to propagate, or propaganda to maintain, I say, with complete conviction that the small individually owned food shops—be they butchers, fishmongers, fruiterers, or grocers—that are holding their own against the giants of food retailing are abundantly upheld in the battle by their use of refrigeration.

Take as a first example the shop of R. E. Hall & Sons, of 45, Lower Addiscombe Road, Croydon : a corner site with a large window on the main frontage, presenting a remarkably representative display of meat from carcase to cutlet. Included in the collection is a refrigerated show of over 30 trays of small goods, each clearly described and price-marked.

How easy Mr. Hall makes it for the many young housewives in his district, who are not so knowledgeable on meat as their grandmothers were, to buy economically and discriminatingly.

They don't have to go to the supermarkets—and there are at least half a dozen of them in Croydon—in order to have their meat buying made as simple and selective as possible.

With the understandably enthusiastic encouragement of Frigidaire and of Trembath & Co. Ltd., their distributors for this district, Mr. Hall uses a permanent announcement at the bottom of the plate glass to draw the attention of his customers to the fact that the base display is refrigerated.

He told me that his only regret, ever since the installation was completed in

Mr. Hall's shop at Croydon has a window display that attracts young housewives.

Another display which makes selection easy is provided by Mr. Miller at Motspur Park.

August, 1959, is that he did not have it put in five years earlier. "I wonder now how I managed without it," he said, "Regardless of the state of the weather or the time of year, I can always have a good display, and customers get into the habit of making their selection before they enter the shop. There isn't the dithering that there used to be: they always know what they want."

Mr. Hall has a 750-c.ft. Frigidaire cold room below the shop. He was apprenticed in this very same shop and, in due course, acquired the business. Robert junior, now with his father in this business, is equally keen on refrigeration.

Also proud of his refrigerated window and its source of origin is Mr. H. F. Miller, of 349, West Barnes Lane, Motspur Park. This window has an even larger selection than that of Mr. Hall.

Mr. Miller started a butcher's business here only two years ago. There was no goodwill to take over, the shop having formerly been used for an entirely different trade. But Mr. Hall had a vast knowledge and a long experience of butchering, having already retired twice after building up successful businesses, and it was that knowledge of meat and how to present it hygienically and attractively that caused the business to grow rapidly.

When the refrigerated window base was first installed, it was 9 ft. wide and 2 ft. 6 in. deep; but Mr. Miller found that insufficient, and Trembath's had to increase the depth to 3 ft. 4½ in. He has now called them in to extend his cold room from 400 c.ft. capacity to 600 c.ft. The refrigerating machinery comprises a Frigidaire forced-air evaporator, working in conjunction with an air-cooled reciprocating type condenser and a Frostmaster de-frosting system.

In this shop there is also a 6-ft.-long Manhattan minor quick-frozen food cabinet.

In contrast to these two typical butchers' premises with their closely packed windows, is the shop of Mr. Arthur Flay, trading as Flayfell, at 65, Matbles Way, Tadworth. One of a small group on a new housing estate, it breaks from traditional design in several respects; yet is unmistakably a butcher's shop.

Here, except for a small hanging rail display, the back of the window is left clear to enable customers to make their selection from inside the shop if they prefer to do so. The refrigerating machinery is housed below the window base, and ventilation for this is provided by one of the grilles inset in the black marble-faced stall-riser.

This refrigerated window slab, which has a low glass screen immediately behind the plate glass in front and on the right-hand side, was installed by Trembath's last August. When I asked him whether he was satisfied with the results, Mr. Flay said, "I can unhesitatingly say that it has put my trade up by £30 a week."

It is not exaggerating to say that Mr. George Wolff's fine old corner shop a

The interior of Mr. Miller's shop is equipped with a frozen food cabinet well surrounded by meat.

A modern shop-front and an open-backed refrigerated window brings trade to Mr. Flay's premises at Tadworth.

Huntingdon is one of the attractions of that interesting and historical town. Although he has no supermarket competition at present, he is well prepared to meet it when it comes. He is seen on the left of the picture behind the left-hand window with its magnificent display of meat, and three of his staff are behind the main counter. The other window is given up to frozen food display.

This shop is unusual for a butcher's in having *two* display cabinets given up to quick-frozen foods. They are both Prestcolds, installed by The Bedford Refrigeration Co. Ltd. Unfortunately, it was not possible to take a photograph of them and show the interior to proper advantage as well, so I have had to be content to show one end of one of the cabinets.

Next month I will show a photograph of the shop of Mr. Peachey at Ludlow, to which I referred last month. It was a co-operative achievement so far as refrigeration is concerned: Walkers (Liverpool) Ltd. working in conjunction with Drakes of Bournemouth. The installation comprises the counter seen in the picture, which, with the window, forms a 16-ft. refrigerated display, a 500-c.ft. cold room for vegetables, an 8-ft. frozen-food cabinet above which Drakes have installed one of their Coolwell refrigerated display slabs for provisions or other perishable foods.

The Siting of Vending Machines

THE incorporation of refrigerated vending units in frontages has been a problem in most Scottish centres because of the newness of the development and the difficulty of marrying bulky refrigerated units externally against a frontage which is itself pressed close to the traffic route.

Where new shops are concerned, the location of vending units is obviously simpler provided that adequate attention is given to the function, dimensions and appearance of the vending unit in relation to the frontage design. The trade has given a great deal of thought to the idea of vending shops. These would ideally be units designed specifically to make the best advantage of both refrigerated and heated vending machines. They could either be behind glass or have their machines located within the frontage, leaving internal space for further machines.

So far, caution has been shown in the development of complete vending shops but some progress has been made towards the incorporation of vending machines in existing or new properties. Obviously there must be a sound reason for this attitude.

The milk vending machine is one unit which has obvious potentialities in a retail frontage, and particularly if that unit is a dairy.

An excellent example of purposeful designing for such use comes from Kirkintilloch, where Ross's Dairies Ltd. have located a new shop at Townhead, below a block of new maisonettes. Here the terazzo and marble frontage has been recessed from the building line, to take "in" and "out" doors for the self-service unit, leaving further space for incorporation of a vending unit. Within this recessed frontage, between the two doors, a space also exists for further display, and Ross's have used it here for a four-deck refrigerated bottled-milk unit. Units of this type have been used internally in some of their modernised units, but in this particular case, it is moved outside during the daytime and brought back again at night. Located externally, it is an eyecatcher and a fast unit for the customer who wishes milk only. The refrigerated unit carries a very considerable capacity and is used to receive empties as well as to serve full bottles. The main interest here, however, is in the external location of the milk vending machine. Problem in the majority of shops in Scotland, over the past year or two, has been to find sites for milk vending units. There is absolutely no question as to their success. They have very immense capacity for after-hours' selling and have materially altered the liquid milk sales position in Scotland. So much so, the Milk Marketing Boards in Scotland are all pressing forward with location of machines. These are bulky and demand adequate space, and all sorts of expedients have been used to fit machines into alcoves and doorways which were never originally intended for the purpose. Here at Kirkintilloch, the space has been accurately assessed for such inclusion, and the machine fits very effectively into the frontage.

The vending industry has faced this problem for some considerable time. It is surprising how many architects design shops without thinking ahead to the coming acceptance of vending machines. These vary very much in size and shape, and it is admittedly difficult to determine their ultimate share of retail trading. The uncertainty is a very sound reason for designing flexibly, so that any future development may be accepted. Otherwise, even the most modern shop may well be outdated within a few years. The ideal policy would seem to be, as here, to recess the frontage, so that bulky machines could be located within the recessed area. In the same way, there would seem to be a very strong argument for the construction of false external walls, allowing the placing of vending machines within the cavity so created, should that be desired at some future date. The more progressive groups in Scotland are now building their vending units into their frontages. This is a sound policy and one which will undoubtedly receive much more attention. Meantime, however, the comment from vending groups is that far too little attention is being paid to the requirements of the future and that many more shops could usefully design in terms of vending frontages, even if these are not immediately used.

Tailor-made frontage at Ross's Dairies has been designed to take milk unit.

R. S. A. NEWS

WINTER is again here with time for study and relaxation A way to combine the two has been found by members attending the monthly meetings.

Usually well illustrated with slides and charts, much useful information can be gained from the lectures presented each month. Covering as they do a wide variety of interesting subjects concerning refrigeration and its applications, they are well attended by both members and visitors drawn from many grades of the industry.

Question time following the lectures provides the audience opportunities to clarify any points or obtain further information of the subject.

September 28th saw the opening of this winter's session with a subject concerning a side of refrigeration sometimes overlooked in discussions. This is not due to its unimportance; in fact it is just the reverse, but because it does not come within the average serviceman's field of operation.

" Marine Refrigeration," delivered by the chairman, Cdr. M. B. F. Ranken, is of prime importance to the economy of the country. As he rightly pointed out, the increase of population in this country means an increase in refrigerated transport. And as large quantities of our food comes from overseas, it follows that marine refrigeration plays a vital part in the transportation of that food. Its importance during the two world wars need not be stressed.

Describing the growth of this side of the industry, the audience were told that in 1877 the cold air system was responsible for bringing to this country the first cargo of meat. Although only of 40 tons it was the first step in what became a thriving industry for which refrigeration was responsible.

Other descriptions included CO_2 plants, that superseded the cold air types, to " F-12 " and " F-22 " plants in use to-day. Mention was made of the steam jet system that had not proved the success anticipated. carbon dioxide plants, although still in use, are being replaced by " F-12 " plants. It will be noticed that no mention was made of NH_3. The toxic qualities of this refrigerant, in the event of a leak, preclude its use in the confined spaces of a ship in addition to the danger of contamination of the cargo.

Detailing with the aid of slides the many types of plants, including deep-freezers and air-conditioners, members were shown methods of refrigerating cargo holds. It was pointed out the importance of air flow to ensure even temperature being maintained. It must be remembered that a cargo coming from the other side of the world has to pass through changes of climatic conditions. As a large area outside of the hold is under water, the sea water temperature as well as the ambient has to be taken into consideration especially when passing from a temperate to a tropic and again to a temperate zone as is often the case.

Referring back to air flow, it was interesting to note there are cases where air ducts have superseded deckhead and bulkhead pipe grids for cargo cooling.

As is to be expected, insulation is an important factor and members were told of some of the snags encountered in forming a continuous envelope of insulation round beams and stanchions. Another consideration is the forming of an adequate seal for hatch covers. Additional to the above, is the constant movement of a ship in a seaway for consideration —altogether a vastly different problem to the straightforward installation ashore. Members will recall the lecture on insulation last session that included some of these problems and the methods adopted and being developed to overcome them.

Mention was made of the versatility of brine for temperature control. This is of interest when it is remembered that the types of cargoes can change from voyage to voyage. Indeed, a ship can carry a different type of cargo in each hold in a single voyage ; each cargo demanding different temperatures and humidities. Frozen and chilled meat, citrus and other fruits, bulbs, butter and cheeses are examples. With bananas especially, extreme care is needed to control the temperature, humidity and, when necessary, the heat.

We were shown pictures of long-distance temperature recorders in a refrigerated freighter that enabled a close watch to be kept on hold conditions. Very different from the days when the refrigeration engineer went round the decks drawing thermometers from the wells to take his readings.

As is to be expected, where space is at a premium, shut-off and circulating valves are neatly banked on the bulkhead with the pipework to and from the valves just as neat, following their runs.

With its wide variety of machinery, the modern passenger liner has often been described as a small town afloat. To-day, in the world of refrigeration, this is even more so as was shown. Apart from refrigerated holds and provision cold stores, the marine refrigeration engineer has to maintain air-conditioners in public rooms and cabins, dough retarders, wine and bottle coolers, ice-makers and service cabinets. In fact, the kind of equipment oue meets ashore each day. Of the service cabinets, it is interesting to note that the absorption system has been found to be very satisfactory. Cabinets using this system are to be found in many pantries on each passenger deck.

A form of transportation coming into favour for short sea hauls is the refrigerated container. One type is similar to a lorry body in appearance. Strongly constructed and self-contained with its own condensing unit, it can be taken to the docks, slung aboard as deck cargo and by plugging in to the ship's mains, continue refrigeration during the voyage. Once packed in the container, there is no necessity for the contents to be handled until the destination is reached.

Another field in which refrigeration is playing an important and growing part is that of deep-sea fishing. Fishing grounds now being further afield, this necessitates the use of refrigerating equipment instead of the storage in ice chips after cleaning as was common practice. Refrigeration enables the fish to be marketed fresh and in good condition. It also enables the vessel to remain at sea, possibly for three or four months until the holds are filled. This saves time in returning to port with half-empty holds as has happened in the past without modern methods.

Among the many interesting slides of trawler equipment was that of a 25-ton deep freezer and others of plate freezers for both trawler and factory ship. Included was a plan of a typical layout for a fishing vessel.

Also of interest were views of a whale factory ship showing the slide astern where the whale is drawn up for processing. Obviously, as this type of vessel is away for months, being fed by the whale catchers, refrigerators are an important part of her equipment.

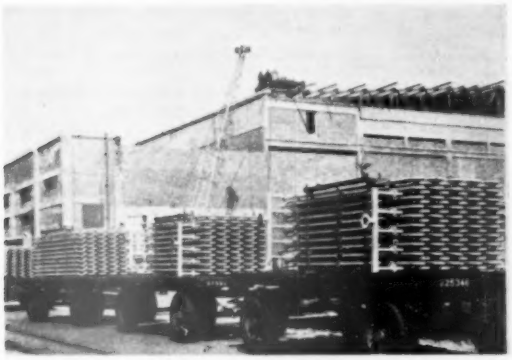
As with all things, an end was brought to this extremely interesting and informative lecture by Mr. T. Clibbon proposing the vote of thanks.

Mention has been made of the slides that apart from equipment illustrated many types of vessels from trawlers to passenger lines. What should be pointed out is the great number used. The number was so great that they flowed enabling smooth continuity to be maintained between them and the subject matter.

It was announced that Mr. J. Douglas, Messrs. L. Sterne & Co. Ltd., has consented to act as president for the coming year.

Wolverhampton Heavy Engineering Firm enters Refrigeration Field

As a step towards expanding refrigeration activity in South Africa to other parts of the world, John Thompson (Wolverhampton) Ltd. have formed a refrigeration division based on the main group of factories in Wolverhampton. Facilities exist here for all phases of heat engineering and refrigeration, including research, design, fabrication, testing and installation of pressure vessels, heat exchangers, pipework and instruments.



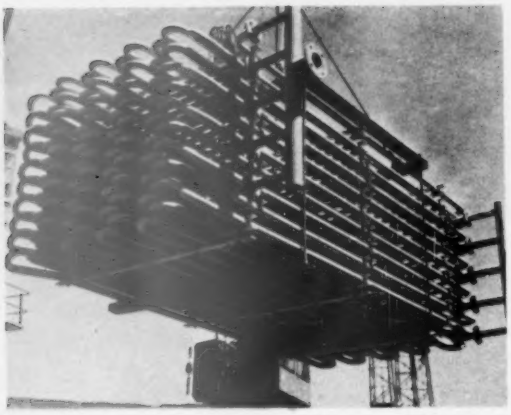
Sixty air cooling units, of the type illustrated, were manufactured and installed by John Thompson for the Capetown pre-cooling plant.

Mr. C. E. B. Cooper, a refrigeration expert who has had nearly 40 years' experience with South African refrigeration work, has been engaged as a consultant by John Thompson (Wolverhampton) Ltd., to direct and advise on the activities of a refrigeration division which has been formed at their Wolverhampton group of factories.

The new division has available sources of the most modern types of centrifugal, piston-type, and steam-jet compression plant. Refrigeration installations can be made for any capacity other than the domestic and retail trade equipment. Specialized designs can be prepared and quotations submitted for refrigeration projects for chemical industry, oil industry, food cold storage and freezing, refrigerated transport of food, and chemicals ; marine and rail transportation ; large-scale industrial air-conditioning ice-rinks and ice-making plants, and indeed the whole field of chemical and industrial refrigeration activity.

To direct and advise on these activities, John Thompson (Wolverhampton) Ltd., have engaged the services of an experienced consultant, Mr. C. E. B. Cooper, who has been associated for nearly 40 years with South African refrigeration work. In his

A brine circulation system for 60 large fruit cooling tunnels. This system, manufactured by John Thompson, incorporates a unique remote control feature for the world's largest pre-cooling plant at Capetown.



Brine-air heat exchanger specially designed and constructed for South African Railways refrigeration by John Thompson at their works in Capetown.

capacity as technical adviser (refrigeration) to the Perishable Products Export Control Board and South African railways, he was responsible for the large fruit pre-cooling stores erected by the government at Ports of Durban, East London, Port Elizabeth, and Cape Town, which represent the largest chain of pre-cooling stores in the world. Mr. Cooper is a past president and now honorary member of the South African Institute of Refrigeration, and has received the institution's gold medal award for services to refrigeration. He attended the recent 10th International Congress Refrigeration as a member of commission VIII of the International Institute of Refrigeration.

New Hussmann Cabinet

A NEW addition to the Hussmann range, the Twin-Department case has been developed to meet the growing number of requests for a cabinet which would combine the frozen foods section with dairy department, each in correct proportionate relationship to the other. The new unit is basically a combination of two Hussmann cases ;

The Hussmann twin-department line, as seen at the Frozen Foods and Q/F Exhibition, here installed at a self-service store.

the MD-L-6 for frozen foods and the Cascade for dairy produce and provisions, but a new profile has been added and two non-refrigerated shelves for allied items are incorporated over the low temperature case.

The cabinet is finished in white high bake stove enamel with extensive stainless steel trims. Fronts are plastic to metal laminated in a choice of seven colours and white.

Elektrohelios Introduce New Range

Elektrohelios, of Sweden, have introduced a new range of deepfreezers into Britain. They will be known as Helifrost Freezers. These units are being made of British sheet steel outside and inside. All sheet metal parts are phosphatized or galvanized under two coats of baked enamel. They have mineral wool insulation and the interior or the lid is of vacuum moulded plastic. Incorporating a Tecumseh compressor, all models have a skin-type condenser.

All Elektrohelios products are fully guaranteed and arrangements have been made for the full servicing of all units. Spare parts will be available from stock held in Britain.

The full range will comprise the following models :

A 5·3 c.ft. small chest freezer. Length 35 in., depth 21⅝ in., height 37⅜ in. Price £110 plus £2 2s. 2d. p.t.

A 7·8 c.ft. chest type freezer. Length 45¼ in., depth 21⅜ in., height 37⅜ in. Price £125 plus £22 17s. 1d. p.t.

A 13 c.ft. chest freezer. Length 51⅛ in., depth 28 in., height 38½ in. This model incorporates a dual alarm system, which gives warning signal if temperature rises or power fails. Price £150 (no purchase tax).

A 19·6 c.ft. chest freezer. Length 71¼ in., depth 28 in., height 38½ in. Dual alarm warning system as above. Price : £220 (no purchase tax).

A 9 c.ft. upright freezer. Width 23⅝ in., depth 23⅝ in. height 67 in. Price : £140 plus £25 11s. 10d. p.t.

Two other upright models, the 15 c.ft. (price : £225), and the 20·5 c.ft. (price £300), are also available.

The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

DECEMBER MEETING

At the meeting of the Institute to be held on Thursday, December 1, 1960, at 5.30 p.m., at the Institute of Marine Engineers, The Memorial Building, 76, Mark Lane, London, E.C.3, Mr. E. J. Perry, associate member, and Mr. P. D. Laing, B.SC., will present a paper entitled "Positive displacement rotary compressors as applied to refrigeration."

The following is a summary of the paper :—

It was felt there was a need in the refrigeration industry for a compressor simple in principle, oil free and where maintenance was reduced to a minimum. On investigating the various compressor designs available it was found that the characteristics of the positive displacement rotary compressor, sometimes called the Lysholm compressor named after the Swedish inventor, A. J. R. Lysholm, might fulfil the refrigeration industry requirements. This paper will describe the principles and characteristics of this particular type of machine. Basically the compressor has two rotors, one rotor having four lobes in a helical formation. The female rotor having six lobes shaped for mating with the male rotor, also in helical form, the two rotors intermeshing with each other but not touching during the rotation. The compression of the gas is achieved by the induction of the gas into the lobe space which is diminished in volume as the rotors revolve. This action compresses the gas contained in the lobe spaces. The machine is oil free, valveless and is not subjected to any surge problems when the pressure ratio or mass flow is varied.

The machine is suitable for most types of refrigerant and has been used with NH_3, R.11, R.12, R.13 and R.22. Circuits and plants using these machines will be described, the operating temperature of one plant being – 175° F.

THE PRESIDENTIAL ADDRESS

By Commander W. R. SINCLAIR, R.A.N. (ret'd.), B.Eng.

PRESENTED on THURSDAY, NOVEMBER 3rd, 1960, in the HALL OF THE INSTITUTE OF MARINE ENGINEERS, LONDON.

Engineer-Commander W. R. Sinclair, R.A.N., B.Eng.

AN OPEN MIND

"YOUR old men shall dream dreams and your young men shall see visions." These millenium old words contrast with chilling emphasis the confused, valueless, distorted picture, rising from the memory of the aged, with the clear bright inspirations of the young, who have the vigour and will to bring them to fruition. It is an awful warning, and yet those of us who are not so young would like to think that both age and youth can contribute to what we are after, real progress. It is in this hope that it is proposed to refer to some factors and aspects of our industry which could, perhaps, suggest to the young suitable fields to conquer. In so doing it is impossible to avoid stating the obvious, but no apology is offered because it is the case that many accepted and well realized truths lose their significance just because they are so obvious and familiar.

The importance of many of these considerations was first brought to notice by association with our continental and trans-Atlantic friends, which in recent years has been so pronounced a feature of the activities of many Institute members, and this has led to some rather uncomfortable reflections and observations.

A quality above all others which it is vital for all of us, including our young visionaries, to cultivate is the open mind. This is not easy or natural but it is the very hallmark of anyone attempting to lead intellectually. Too much self-reliance and self-confidence, settled habits of thought, overwork and weariness, and it must be admitted—a limited education—are apt to constrict horizons to what is personally known and experienced. If it is a question of lands beyond the horizon there must be a willingness to admit the conclusions and experiences of others, which is not easy and requires discrimination as well as willingness.

Probably the refrigeration engineer more readily than most should admit the need for a broad survey ; his activities include a very wide range of interests and contacts, which emphasize the interdependence of theory and practice.

Refrigeration is never an end in itself—it always serves some purpose involving, of course, the elimination of heat. Where does the function of the refrigeration engineer end ? Even if he wishes to restrict himself to the refrigerant circuit he must design the evaporator and at one stage or another be concerned with the end product, with the theory and practice of which he must have at least a nodding acquaintance, if his own particular task is to be fulfilled efficiently.

And within the limits of his own subject there is a range of specialized functions. As an engineer the design and production of each of the many large and small components involve and

touch a myriad of interests from basic science to administration ; and indeed he cannot exclude finance and selling.

He must also regard his work in its national setting, and must be prepared to consider from time to time questions which arise in the context of British industry generally. If it should appear that compared with competition abroad we are not in the first place, let it be clearly stated that adverse criticism of the individual has no place in these remarks ; circumstances of history, conditions of geography, at times the stark need for survival, have an influence far beyond the best efforts of the individual himself. If therefore some critical conclusions emerge these are stated so that as a team we can see more clearly how our individual efforts can result in the finest achievement.

More widely, the setting of all our lives has an international background, much if not most of which is beyond the personal influence of the industrial engineer. We must work on the assumption that matters will be so ordered that in deciding policy we can and should take a long view rather than a short one.

Two Aims Before Us

It will be generally agreed that there should be two clear aims before each of us ; first to know as much as possible of the theory and practice of the sector of work falling to our lot, and second to keep a completely open mind to all matters which we may meet and which may lie beyond our immediate area of knowledge. It has been well said that in all matters of moment a man must either decide for himself or select someone whose decision he will accept. Since the latter course may involve admission of technical, academic or other inadequacy it may be unwelcome, but nevertheless it is essential.

It is a truism that the more we know of a subject the more we become aware of how much is unknown, possibly unknowable ; an intelligent attitude to science on the one hand and the results of industry on the other is respect for the researches and conclusions of the pure and applied scientists and mathematicians as well as for the practical work of the engineers.

The need for this two-way respect was recently referred to by Sir George Thomson, F.R.S., in his presidential address to the British Association for the Advancement of Science. " As science advances, concepts tend to become more and more abstract, further from anything that can literally be touched or handled. This being so is there not a danger that we may lose touch with reality, and end up by supposing that some elaborate piece of mathematics represents reality when in fact it is only a creation of the mind, inspired indeed by physical reality but no more like it than is a modern picture ? I think we are safe so long as the people who make these theories are reasonably close to those who use them, not merely in laboratories but in practice."

The corrective quality of industry has another function, that of drawing attention to factors which may escape the notice of the scientist who is naturally concentrated on a limited sector. The following illustration is quoted with some diffidence as the matter is still under discussion. The problem in a nutshell is that of a code for establishing with reasonable accuracy the performance of a refrigerating plant expressed in terms of thermal elimination and not as a functional duty. The latter may be difficult enough and circumstances make it impracticable ; for example, it may prove impossible to provide the external load ; but it does not involve the same problem as the former. An electric generating plant includes for its everyday work-measuring instruments which clearly show whether or not it fulfils its design duty. The refrigerating plant in general cannot be fitted with a " thermal elimination meter " so to speak. The thermodynamic processes at each stage of the cycle are the subjects of careful assessment, and the success of the plant depends on the performance at each stage agreeing within suitable limits with the design figures ; often it is a case of the pudding being proved by the eating, not by instrumentation, and the word " instrumentation " shows where the obstacles arise.

It is a useful exercise to examine a variety of refrigerating plants, whether cooling gases, liquids or solids, and endeavour to establish methods by which the heat changes in the refrigerant as regards quantity and temperature can be measured, with close regard to the minimum tolerances involved. It is a result of experience that the maximum accuracy is possible for measurements of the performance of the compressor only, and even such tests involve measuring devices not forming part of a normal installation nor required in practice, and which in many cases could not be fitted to a plant either because of space considerations or because they would interfere with normal performance and efficiency. It is readily understandable that these considerations would not occur necessarily to those who are not personally concerned with designing installations under strict conditions of economy in space and cost.

This of course does not mean that a plant is an incohesive vague affair whose components are beyond assessment of suitability ; those engaged in the industry know that adequate criteria of satisfactory performance can be devised and applied even in the difficult case of a dry air cooler cooling high humidity air to nearly freezing-point, which is circulating through a duct system with sharp turns, awkward corners and varying cross-sectional area. The point is that satisfactory proofs of performance can in the general case be devised, but that high tolerances and qualitative criteria may have to be accepted. Clearly also the methods concerned vary so widely that they cannot be scheduled within reasonable limit.

It is with some envy that the engineer in whose practice trial and error inevitably occur, whatever attention has been paid to the design data available, views the academic stronghold of the scientist. The abstract conclusions of the pure scientist and mathematician which withstand the scrutiny of the keenest and most able academic minds, have an intellectual authority which compels our admiration, perhaps at times in inverse proportion to our comprehension. Indeed, the unworthy suspicion intrudes itself that the status conferred by these academic attainments sometimes does less than justice to the engineer. Unworthy, because the abstract and applied scientific and mathematical disciplines demand the closest attention of us all, and the engineer must stand on his own feet.

The Safety Code

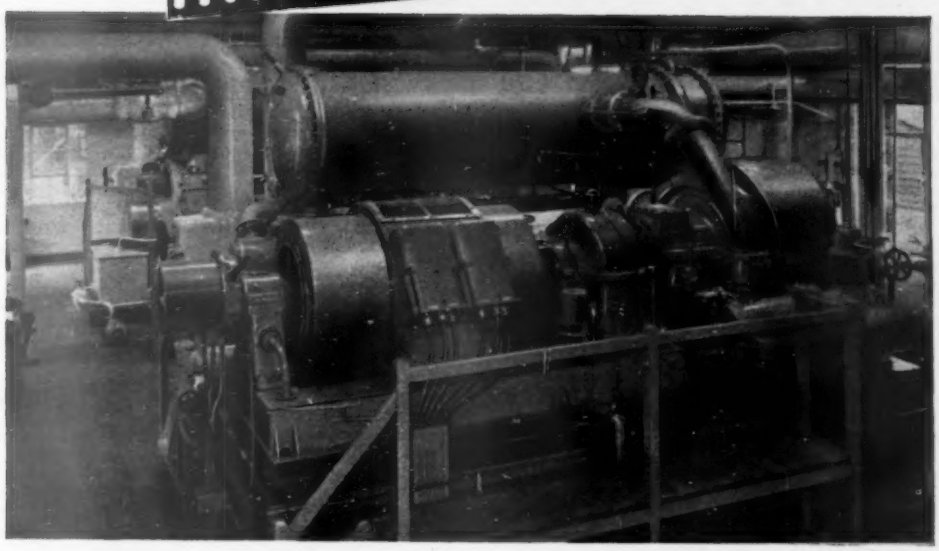
When the safety code was under discussion by an international body, there was a proposal to accept as it stood the U.S.A. code, which was the result of many years of experience with accidents and what was done to deal with them. But the Continental scientist, perhaps belonging to a long logical tradition of academic study, said it would be better first to ascertain the principles underlying the code and then after considering them objectively to apply them to conditions as seen over here. It is interesting to note that Sir George Thomson, in his address and in a wider context, said that the best way to make advances in technology, whether on the medical or engineering side, turned out to be to understand the principles. " This is quite a recent discovery, indeed it has probably only recently become true." Back to " first principles " is a policy which the harassed designer or applications engineer may find it impossible to pursue, but the practical obstacles in the way of following it must not blind us to its soundness and indeed vital importance.

This is not the occasion to propose provisions for a safety code but the reference to " first principles " tempts one to refer to conflicting considerations, often basic in their nature, which have to be borne in mind. The engineer on the one hand must view every accident as a reflection on the design, materials or operation of a plant, with all of which he is associated ; on the other hand, he must realize the cold truth that absolute safety and reliability in automicity are really unattainable, and that in any event the effort to attain the absolute may overload the plant with devices, each of which has its own fiendish tendency to misbehave, so that acceptance of some risk may be justified by the greater practical attainment of safety and reliability which is conferred by simplicity. Again he may think that if greater care were expended on design factors which would minimize or prevent the possibility of accidents, there would be less need for restrictive and sometimes questionable requirements which seek to minimize the effects of accidents should they occur. In the effort to bring science and engineering closer, and to effect greater mutual respect, it was suggested that those engaged in the abstract studies had an advantage. The engineer must face this and should not be content to rely only on his undoubted success in the practical field, but seriously to enquire whether there is anything in his technical thinking which requires to be improved.

Our Technical Performance

It is apposite to compare our technical performance with that of other countries, and sufficient examples may occur to each of us to indicate that we could do better. The initial dis-

1,350 TONS of REFRIGERATION for KODAK Ltd.



The illustration shows one of the three CENTRIFUGAL REFRIGERATING MACHINES supplied and installed by J. & E. Hall for the Harrow (Middlesex) Works of Kodak Ltd. They are used for controlling temperature and humidity during the processing of their products. With a total b.h.p. of 2150, the machines have an output of 16,200,000 B.t.u./h—equivalent to 1,350 tons of refrigeration!

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claimer is repeated, that here is no criticism of individuals, which would be wholely out of place and unjust. It is fatal to fall into the error in inductive reasoning of deriving an established principle from insufficient data, but there does seem to be an hiatus between the brilliant performance of our finest scientists and the development of their work into applied engineering. Are we open-minded enough ?

Let us consider physics, the basic tool of all engineering, a section of which deals with units. A distinguished predecessor in this chair a few years ago advocated as a useful activity an attempt to follow the Continent in their system of units. Probably most of us felt it to be such a huge task that the existing system is such an integral part of our thoughts and practice, and that it was somebody else's function rather than ours, that it would be a useless expenditure of effort. This may be so, but there can be no doubt that it would simplify teaching and calculation and would have another consequence to be referred to later. The Ancient Roman Civil Service, that majestically constructed organization, seems to have used Roman numerals, and the wonder is how long it took to work out a long division calculation. When one contrasts such a system with the simplification introduced by the Arabic notation it might be thought that the time and effort saved by its use might have delayed the Decline and Fall ! This may be true in spite of the mental agility cultivated by the use of a difficult system, for example our own tables with their 30¼ square yards per square pole, perch, etc.

Those of us engaged in the day-to-day task of dealing with technical problems, pressed by time, and accustomed to systems taught some years ago may not be aware of the extent to which the paths of engineering practice, and the teaching of physics have diverged. It may be that our engineering practice is well based and needs no revision, but let us be very certain that this is so before we refrain from considering what is implied by the modern methods of viewing physical subjects.

A tolerably convincing picture that our practice is not beyond criticism is given by the opinion of a modern physicist about the standard pressure gauge. His objections are that however meaningful its indications are to one accustomed to use it, its marking uses a variable and confusion-causing quantity, the pound, and also the inch, which is not a basic unit. These criticisms may appear slight but their force increases by reflecting on what lies behind, provided we direct our minds to the modern scientific enthusiasm for simplified, absolute units and a clear conception of what is involved by their use.

Those of us accustomed to the use of gravitational units would admit, it is hoped, that making weight the fundamental unit does not help in apprehending the idea of mass. One is led to consider mass as a derived and secondary conception, and weight by its familiarity is more agreeable to the experience of our everyday life. But the practical soundness of buying sugar by the pound, especially with weighted scales, and the small likelihood of us ever buying any on the moon with a spring balance, should not lead us to forget that a spring balance would give us a quantity depending upon the value of the gravitational constant (so called) which varies quite considerably even on the earth. The physicist probably enters a mental protest whenever he buys his sugar and says to himself that what he has bought is a mass of sugar reputed to be attracted to the earth by a force roughly equivalent to the weight of a pound mass, with considerable reserve about the definition of the word " pound " and whether this definition has anything to do with force.

We are used to it all, and as " W over G'ers " as the physicist calls the adherents to engineering units, may be inclined to dismiss the subject rather cursorily. But if only to narrow the gulf that divides us from the physicist and to integrate better our activities, it is worth while to consider what principles lie behind the changes which have been made in teaching the elements of physics.

It seems possible that the decision to avoid any formula involving the word " pound " being used for both force and mass, was hastened by the post-war interest in space problems. However that may be, some modern American text-books insist on the M.K.S. system and when the pound is used it is strictly as a unit of force. In the metre kilogramme second system the unit of force is the Newton which produces an acceleration of 1 metre per second per second in a mass of 1 kilogrammes. Thus there is available an absolute invariable unit of force. Seriously, as science should have no curtains we may already see U.S.A. and Russia using gauges marked in absolute units which commemorate a distinguished English scientist, with what consequences for good who can tell !

Simplification is the principle behind the break in the tradition which is seen in recent teaching, a break claimed to enable students to grasp more readily and rapidly the enormously increased range in pure and applied physics apparent in recent years, including nuclear and quanta concepts.

And a wider range appears ; again quoting Sir George Thomson, " there is excellent reason to believe that the whole of chemistry is explicable in terms of electrons."

The Matter of Symbols

In connexion with chemistry has there been a retrogression of its association with the refrigeration engineer ? A recent discussion concerned the identity of refrigerants and the confusion possible arising from the use of numerical identification. Such a state of affairs never existed in the case of SO_2, CO_2 and NH_3, defined clearly by their chemical symbols. It may very well be that non-technical staff unfamiliar with chemical nomenclature use the identifying formulae as instructed, aided by the fact that the gases are not unfamiliar in normal life. But the synthetic and unfamiliar nature of the " Freons " may not be wholly responsible for the non-use of chemical symbols to identify them. Trade terms were used, as seemed natural to a generation apt to invent new words, perhaps impatient of tradition, a little apprehensive of confusion in identification, and, it may be, minded to conceal their constitution. It may be that however trippingly CO_2, etc., fall from the tongue, we hesitate to use CCL_2F_2 or whatever it is as too closely resembling other halogen derivatives. But if all concerned had been more attached to traditional methods the labour of recent committees might have been lightened or avoided.

Some reference must be made to electricity, whose techniques are closely associated with our conventional plants. Recently there are signs of a more direct association with refrigeration.

In the search for economy and simplicity an obvious line of attack is in connexion with the losses involved by electro-mechanical conversion. Thermocouples in reverse are now being developed ; and electronic phenomena, such as are associated with semi-conductors, attract attention. Coming in the range of our visionary telescope we may see some sort of realization of Maxwell's Demon sitting by his trap-door allowing the high-velocity molecules to pass and stopping the slow ones. Perhaps not molecules but electrons, and a fairy tale may become real.

To summarize, it is submitted that we should try to ensure that the discoveries and advances of pure and applied science are investigated without the loss of time which delays and may prevent their development by industry.

There is evidence that collaboration between science and industry in the United Kingdom compares less than favourably with the situation abroad, including, if not specially, in Russia.

It would assist the association of science and engineering if we all spoke the same technical language, and the importance of the M.K.S. system in this respect is increased by its value in clarifying basic ideas and by the ability to express these ideas without the ambiguity which is unfortunately associated by the word pound being used for both mass and weight. Action in this conversion appears to be taking place, at any rate at university level, in the U.S.A.

We can assume that the position is very clearly known to the educational authorities and the great technical institutions and leaders in industry, and perhaps if anything need be done, and can be done, the initiative rests with them. Nevertheless, although a small Association, representing a fairly small industry and not possessed of great resources, we like others must advance if we are to survive and cannot contract out of our responsibilities.

We should, at least, direct our minds to arrive at a reasonably sound judgment of the position, so that if we decide that co-operation with others is indicated, appropriate action can be taken.

Whether we move in the matter or not, only good can follow from endeavours to establish our association more closely with basic science, good not only to ourselves but, as Sir George Thomson has pointed out, to science also. The vision is commended to those on whose efforts the older generation depends.

This address started with a quotation, and I venture to end it with another " It is not given to mortals to command success ; we shall do better—we shall deserve it."

DEEP FREEZE and the Processing of Baked Goods

By J. T. Herbert, M.Inst.R.*

I PROPOSE to start with a short history of the freezing of baked goods. Research into this began in 1932 when bread was kept at +15° F. for three days and retained its freshness. Nothing further seems to have happened until 1939 when two research workers, W. H. Cathcart and S. V. Lubes, carried out some experiments to delay the staling of bread. They found that at -4° F. bread remained in good condition for about 40 days, whilst at -30° F. this period could be extended to over 8 months.

Your own research station at Chorleywood carried out some experiments in 1951 because several bakers in this country were already trying their hand at conserving baked goods in a small way and it was felt that more should be known of this subject. These experiments at Chorleywood proved that baked goods could be conserved and still be palatable and apparently equivalent to fresh goods for periods up to 12 weeks. Nothing much further appears to have happened till 1955 when further experiments were carried out again at Chorleywood to determine the optimum conditions for the freezing and storage of baked goods. At first, temperatures above 0° F. were used, but these proved unsatisfactory because although the goods had a freezing range between 22° and 29° F. and most of the water content froze between these temperatures, the presence of small quantities of salt and sugar prevented freezing from being complete and it was found necessary to use temperatures below 0° F. As you have seen previously this afternoon, small amounts of water vapour can exist in the unfrozen state down to very low temperatures, but will continue to crystallize if the low temperature is maintained. The presence of salts and sugar in solution also tends to prevent their water content from separating and freezing unless very low temperatures are used. It appears that unless a very high proportion of the water content is frozen in a short time, then staling will not be reduced to the low level which is necessary. Regarding staling, this is at a maximum between 30° and 50° F. and during the initial temperature reduction, the goods are not safe from staling until below 18° F. This appears to be the danger range in the first instance, but afterwards it is necessary to reduce to -5° F. as soon as possible, which temperature is the economic minimum for the storage periods usually required for baked goods. Let us see what is involved, as far as heat extraction is concerned, in freezing baked goods. As we already know the specific heat is around 0·6 B.t.u. per lb. per ° F. above freezing, the latent heat of freezing is between 43 and 58 B.t.u. per lb. and the specific heat below freezing somewhere about 0·44 B.t.u. per lb. per ° F. We will assume the product enters the freezer at an initial temperature of 90° F., that the final temperature is to be -5° F., and that we are freezing 1 lb. baked goods. Thus, for every pound of baked goods frozen we have to remove approximately 102 B.t.u. This figure will vary slightly for different types of goods according to their water content.

We can now re-cap on those factors which enter into and control the practice of freezing baked goods. These are as follows :—

(*a*) To prevent or control staling and enzymic action we must reduce the temperature as quickly as possible through the staling range, and thereafter to the optimum storage temperature of -5° F.

(*b*) To prevent deterioration during storage we must ensure that as little variation as possible takes place in the storage temperature.

These factors and some others must be taken into consideration by the refrigeration engineer when he is called upon to design a plant for the freezing and storage of baked goods. How does he go about ensuring a rapid rate of temperature reduction ? How does he arrange his installation so that there is as little temperature variation in storage as possible ? I will attempt to tell you.

Firstly, upon being called in to advise on a particular installation, the refrigerating engineer must obtain some specific information from his prospective client. He will want to know the type of products to be processed, the maximum daily loading, the maximum quantity to be stored, the type of trolley or rack, and whether baskets or sheets are to be used. He must take details of the proposed site, ascertain whether built-in or sectional construction is required, and satisfy himself, if built-in work is called for, on details of the sub-soil and level of the water table. Electrical characteristics are required and also the availability of a water supply for the plant. Having obtained all this information and also satisfied himself that he and his client talk the same language, for this is an important point—it is amazing how many people say one thing when really they mean something entirely different—the engineer is then in a position to go away and get down to his drawing board and begin to plan the layout.

If the proposed plant is a fairly large one, it will undoubtedly warrant having separate freezing and storage compartments. We have seen the importance of rapid temperature reduction during freezing, and also the desirability of maintaining as even a temperature as possible during storage. Unfortunately, these two aims do not go hand in hand, as will be realised, and therefore, if at all possible, it will be the engineer's aim to get these jobs done separately. The freezing load is far greater than the holding load and what is more, the freezing must be done rapidly, which calls for a lower air temperature in the freezer than is perhaps necessary in the store itself. We saw earlier that the greater the temperature difference between two bodies, the more rapidly is heat transferred from one to the other, and the engineer must use this principle in designing his freezer compartment. I will endeavour to show you what happens in the freezer during freezing time.

Here we have three curves based on time and temperature (*not given here*) ; the top line indicates the fall in temperature of the baked goods and you will notice the levelling up of this curve whilst the product passes through the zone of maximum crystal formation. The middle dotted line is the air temperature in the freezer and the lower line is the temperature of the refrigerant within the cooler coil. The three crosses indicate the points where freezing is deemed to be complete, and it is at these " final temperatures " as they are called, that the engineer bases the size of his cooling coil, and the h.p. of his refrigerating compressor. When he has calculated the total refrigerating load, which not only includes the freezing of the product but must also encompass heat gain through the insulation, heat input of fans, air infiltration, and other sources, he then divides this by the time in which he wants the operation carried out, and this gives him the load in British thermal units per unit of time.

He must then ask himself, at what final temperature difference will the product give up its heat in the time I want it to do so ? This information must needs come of experience, because there are other factors which have some bearing on this answer, such as air speed, type of surface being cooled, whether any wrappings or containers must be allowed for, and other things. However, by and large, it is the final temperature difference between product and coil which determines the speed of freezing and the greater this is the more rapidly will the iob be done. Unfortunately for the engineer, he is on something of a losing wicket, for the lower the temperature at which he decides to operate his plant the smaller the heat extraction is for a given h.p. The next slide shows how this state of affairs comes about. Here we have the capacities of three condensing units plotted against a temperature base and from this you will see that a nominal 5-b.h.p. machine has a capacity at -12° F. equivalent to a nominal 10-h.p. machine at -28° F. and a nominal 15-h.p. machine at -40° F. The figures shown on the graph are of course approximate and the actual h.p. absorbed is shown in brackets against the duty line. The reason of course is the larger swept volume required at the lower temperature and therefore pressures to deal with the more varified refrigerant.

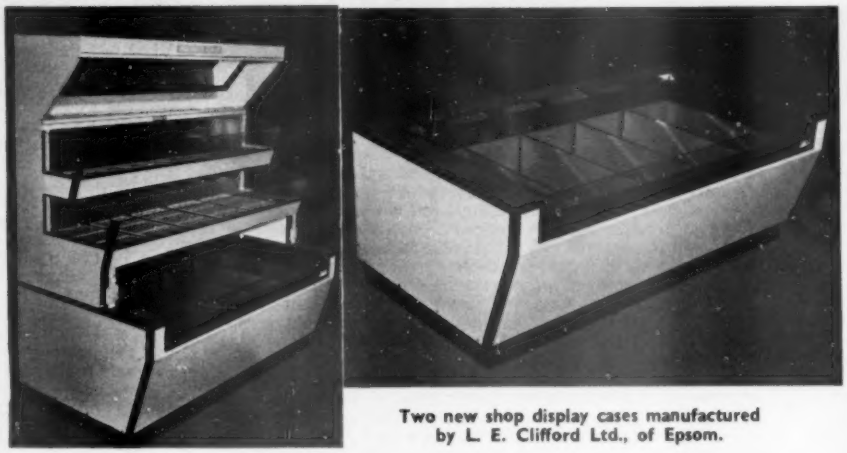
The engineer must therefore exercise care in selecting his machine as otherwise the total cost of his installation may outweigh its advantages in speed of freezing. He must, however, ensure that his plant has a capacity great enough at the final evaporating temperature, to complete the removal of heat from the product in the time required, and at the same time to do this with a temperature difference great enough to cause the product to give up its heat. Unless these conditions are fulfilled, the plant will be unable to perform satisfactorily.

(to be continued)

* Extracts from an address delivered before The British Chapter of the American Society of Bakery Engineers, Piccadilly Hotel, London, October 11th, 1960.

COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and Distributors' News



Two new shop display cases manufactured by L. E. Clifford Ltd., of Epsom.

Mr. J. K. Benson, a director of York Shipley Ltd., refrigeration engineers of North Circular Road, London, N.W.2, has retired after 31 years of active service with the company. Mr. Benson joined the company as a chief accountant in 1929, was promoted company secretary in 1932, and appointed to the board in 1938. Since then under a succession of managing directors, he has been responsible for the financial affairs of the company, and has contributed greatly towards the successful expansion of the company's activities.

* * *

General view of the large cold-room installed for Yorkshire Turkey Packers Ltd. (Polpak) at the Merton Mill, Bolton, is shown right. Fully-automatic refrigeration has been designed and supplied by Southern and Redfern Ltd., of Bradford, Yorkshire, main distributors for Frigidaire Ltd., and construction of the low temperature store has been carried out by B. Jaquiss and Sons Ltd., of Manchester. The cold store, covering 12,000 sq. ft., has a capacity of around 100,000 c.ft., and operates from 0 to -5°. It will store approximately 750 tons of turkeys or poultry. Equipped with six Frigidaire model WD.8H.1,000 10-h.p. condensing units and six Frigidaire model SFF.103D. floor mounted coolers, the high velocity air refrigerates the room to below zero °F. at the rate of about 36,000 c.ft. of air per minute. The coolers are fitted with Frostmaster automatic electrical defrosters. Cooling water for the refrigerating machine comes from natural sources. Construction of the cold store is somewhat unusual, being freestanding with independently constructed walls. The considerable area of ceiling, however, is supported by suspension from the existing steel joist construction of the mill. Insulating material used include 7-in. polystyrene for the ceiling and 6-in. polystyrene for the walls. Floor insulation consists of 2-in. thick Onazote and 4-in. cork slab. The wall construction is also novel in that timber dunnage battens, the full height of the room,

A general view of the 100,000 c.ft. cold room installed for Yorkshire Turkey Packers Limited (Polpak) at Merton Mill, Bolton, Lancashire.

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have been employed to form a basis of the construction. Three access doors and three hatch doors have been provided, each having electrical heaters to the gaskets. The doors have a pleasing appearance, having been finished in hardwood facing and stove-enamelled aluminium panels. Thermal contraction of the granoconcrete topping to the floor, consequent upon the large area and considerable temperature reduction, has been taken care of by the incorporation of special expansion joists. Electrical installation and distribution has been carried out by Arthur Barrow & Son Ltd., of Bury, using B.I.C.C., mineral insulated cables to ensure complete protection against condensation.

* * *

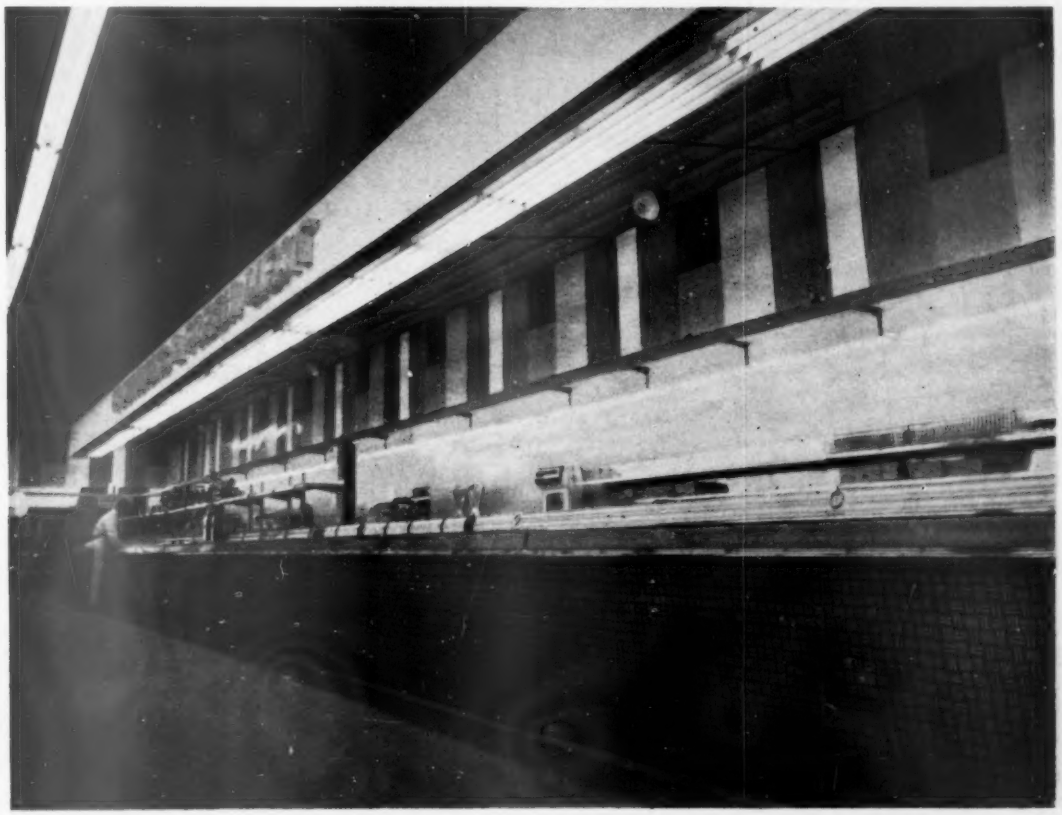
Cargocaire Ltd., of London announce that Mr. Peter L. Grant, B.SC., M.R.I.N.A., has been appointed a director of the company. Cmdr. Francis L. Boyer, who retired from the Royal Navy in 1946, has been appointed manager of marine sales.

* * *

A " stable-type " flexible door for cold rooms—known as a " Minidoor,"—has been developed by **Minikay Ltd.**, Friars House, 39/41 New Broad Street, London, E.C.2. Experiments have shown, states the company, that is is not necessary to have full-height flexible doors in order to maintain a satisfactory temperature control in refrigerated rooms held at + 32° F. and above. With the growing trend to use mechanical handling in cold rooms, the need to have good visibility through the doorway is becoming of major importance. By using " Minidoors, visibility is completely unimpeded over the top of the doors, consequently nuisances associated with the usual gradual deterioration or misting up of normal observation panels is eliminated. This development makes use of the well-known

fact that if cold air is prevented from falling out of the doorway, when the insulated door is opened, warm air cannot enter.

A refrigerated food display counter—over 60 ft. in length —has been installed by Prestcold at " Supa-Save," Britain's first discount house and supermarket. This is one of the longest counters of its type in the country. The supermarket opened at Southend a few weeks ago and thousands of people queued in the rain to buy goods at special cut prices. After 15 minutes the doors were closed again so great were the crowds. Later, during the same day, over 13,000 paying customers passed the 11 cash desks at the exits.



N.F.C.S.I.T. President Condemns Government's Reported Intent to Break Pledge

(*refer to page 628, October issue*)

"MAY I thank you, Lord Waldegrave, for your most gracious remarks. In point of fact, having heard what you have said about the company of management, it would appear that you earnestly support it and should prove, as far as we are concerned, a good advocate." Declared Mr. Eugene Ruddin, C.B.E.

"At the same time, I should like to thank you very much for being with us to-day and it is with great pleasure that I acknowledge your toast.

"I sincerely hope that many of you who are what one might call habitués of this function, do not feel any slight because we have omitted the traditional toast to our guests. If you do feel that we have been ungenerous, then blame your immediate hosts, our members, who earlier, in the year, told us that they thought it would be better if more time were given to the socialities of the lunch and that if speeches and toasts were to be made to guests, then they would prefer to make them. I hope then that their hospitality is unabounding.

"Accompanying Lord Waldegrave is Mr. Bishop, deputy secretary of the Ministry of Agriculture. He is accompanied by Mr. Carnochan, and Mr. Bishop being so called I hope that he will engender some ecclesiastical regard as to the moral responsibilities of the Government when it deals with the present problems that face the cold storage industry.

"We, too, welcome the directors of the National Cold Stores (Management) Ltd., and I particularly mention Mr. H. E. Davis, chairman, and Mr. Hillhouse, general manager.

"With us also, we have, representing the Institute of Refrigeration, Commander Sinclair, their president. I should like personally to congratulate him on his appointment and say how pleased we are to have him with us, and indeed, his colleague, Colonel Randal Steward, whose affability is known to many of you.

"One of our guests of honour is Mr. Parratt, president of that most important body, the National Association of Quick-Frozen Food Producers. Many of you will remember that Mr. Parratt was extremely forthright with his remarks last year when replying to the toast to the guests. What he said was substantially true in regard to what is, after all, a specialized subject. I must further hasten to add that what he said had nothing whatsoever to do with the omission of the toast to our guests this year.

"Mr. Parratt, many of you will observe, is accompanied by Mr. Mitchell, the worthy secretary of the producers' organization.

"A near relation of the processors is with us, by name the National Association of Wholesale Distributors of Quick-Frozen Foods, commonly called N.A.W.D.O.F.F. Unfortunately, Mr. Gilbert Parrott has been laid low with influenza and he is represented by Mr. Sheasby, secretary to the organisation and we all hope that he will send our good wishes to Mr. Parrott for a speedy recovery.

"Both the processors and wholesalers of quick-frozen foods are to be congratulated on the most excellent work they have done. I am quite sure that the advice of their executives of the general body of their trades will do much to maintain standards and methods of business in this most important section of the trade.

Lastly, but by no means least, I have pleasure in welcoming warmheartedly representatives from our affiliated body, the Scottish Association of Cold Storage and Ice Trades. Mr. James Mackenzie, their president is here, accompanied by Mr. Finlay and Mr. Kenneth Walker. One has only to visit Aberdeen where these people hold their annual general meeting to appreciate what an excellent feeling exists throughout their Association. As a matter of fact, the comradeship is so great that, outside the fact that all competitors in their golf tourney receive a prize, this year, as one of the few Sassenachs, I won first prize, although I failed to hole-out at one hole during the medal round, as I had lost my ball! True, I was accompanied by their past-president and Mr. Kenneth Walker, their secretary, who marked my card. I was criptically told "We cannot wait while you go back and drop another, so we can give you 7," and down it went; and what could I do? After all, I was a guest among charming hosts. One nevertheless appreciates this independence of view and realizes that even the rules and regulations as defined by the Royal and Ancient Golf Club are set on one side when it suits. It is quite something in Scotland, where the R. & A. almost ranks next to the Almighty."

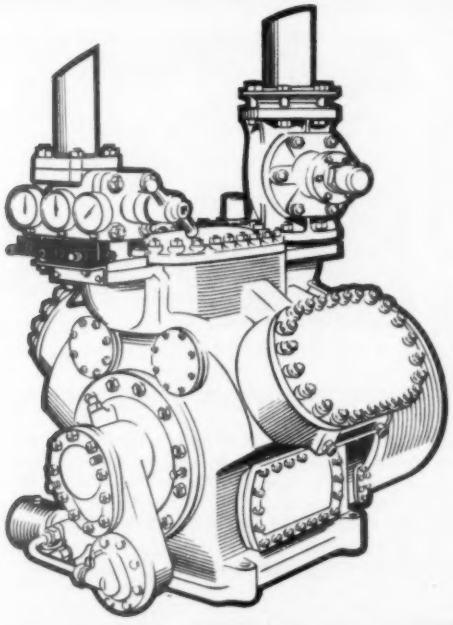
Raising the matter of the Government pledge on the national cold stores, mentioned in our October issue, Mr. Ruddin declared: "Why were pledges given to the industry by the Government? That is the crux of the matter. The answer is simple and of historic fact.

"It relates to the 1914–18 War when cold stores erected by the Government were subsequently sold at 'knock out' prices. This was one of the main causes that brought about the tragic state of the industry during two world wars, and it was during this period that many stores were closed down. In consequence, when the emergency arose in 1940, the Government found itself short of cold storage accommodation. It was, therefore, compelled to enter upon an extensive scheme of building 47 stores of a total capacity of some 15,000,000 c.ft. and this, at that time, represented an increase of 40 per cent. of the available space.

Three-Point Pledge

"The project was, therefore, designed to meet a national emergency, that and nothing more. In consequence, the Government gave the industry definite undertakings, because of the 1914–18 experience, the essence of which was that on the termination of their usefulness to the Government, these stores would

LIGHTFOOT



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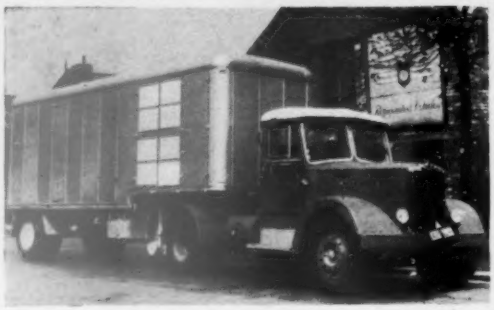
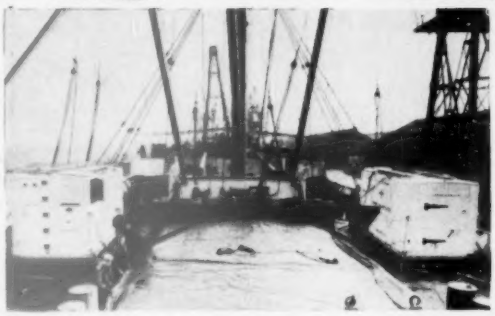


10-ton capacity refrigerated meat transport vehicle for Iran operating at —10°F.

Refrigerated milk transport vehicle operating at 40°F.



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		DUBLIN	Dublin 71316		

be dealt with in three ways, and these, gentlemen, are the pledges given :—

1. The new stores may be retained on a ' care and maintenance ' basis as a permanent reserve.

2. The stores may be dismantled and the sites sold or disposed of as the Government may decide at the time, or

3. The stores may be offered to the industry at a price determined by an independent valuation. These pledges were initiated on behalf of the Government by Mr. W. S. Morrison, to-day Lord Morrison, who was at the time Minister of Food, and were later confirmed and underlined by his successor, Lord Woolton.

" You will appreciate, Sir, that there is plenty of scope within those pledges to permit the Government adequately to dispose of the situation without causing distress to the industry. However, in 1955 the Government agreed with the industry to promote and join in a company of management to take over control and direction of the Government cold stores. This arrangement was applauded in the House of Commons by Mr. Heathcoat Amory, then Minister of Agriculture, Fisheries and Food and the arrangement has worked extremely well. We, the industry, say that, in every respect, the existing company is still the best method of taking care of the present situation.

Pledge to be broken ?

" Why then does the Government contemplate breaking its pledges ? Why then is this company of management of only five years' standing treated in such a cavalier fashion ? Who has caused this change of front ? We certainly do not think that the Ministry of Food wish it. Is it because the present company of management does not make profits ? No, that is not the answer, because profits are made, and I might say, not in competition with the industry.

" Is it because there is lack of efficiency ? Hardly, the Government themselves has stated in the House of Commons that it regarded the company as a very efficient piece of machinery. Is it that the cost to the Government of its strategic stocks is high ? This cannot be, because Mr. Amory pointed out that this was an economic arrangement and in any event, the charges for storage are subject to scrutiny by the public accounts committee and the goods could not be stored cheaper.

" I invite you to read what Mr. Heathcoat Amory said in the House of Commons about this matter on March 19, 1956, prior to which, Dr. Charles Hill was equally strong in a debate on the subject on November 23, 1954, and although I quoted these particular references in full a year or two ago, I feel the matter is so very important that I must refer to two short extracts. The first is that of Dr. Charles Hill and this is what he said :—

> ' *The Government has taken the view that the pledge, given incidentally by a Coalition Government, should now be honoured, even though it may be difficult and inconvenient to do so, and that the fact of difficulty or inconvenience should make no difference to our determination to honour it.*'

" On March 19, 1956, Mr. Heathcoat Amory stated in the course of debate:—

> ' *A definite pledge was then given to the industry that they would not be used after the war in competition with the trade. The hon. member for Sunderland North (Mr. Willey) suggested that we might review that pledge. I do not think so. It was a specific pledge and I consider that it ought to stand.*'

" There is no suggestion here, gentlemen, that the pledges should be limited to three, four or five years.

" I ask again, what has happened to cause this *volte face* ? Who, indeed, has raised it and why so suddenly ? The excuse, and I can put it no higher than an excuse, is, we are told, political. Is it not extraordinary that the Government itself makes every political point in the Commons justifying its actions to the hilt and without giving reason, within four years it completely changes its mind. What has prompted it ? Why is it that logical consequences which so strongly support the maintenance of the present situation, should now become a scarecrow to the politicians. It just doesn't add up, and to follow what would appear to be the political line at present envisaged, it will without doubt cause havoc throughout the industry and the closing of small stores which, I might add, were stores which were found most necessary to the national requirements during the war, and if this should come about, it would be to the Government's eternal shame.

Only One Choice

" The Government should therefore clear its mind and introduce practical thought into its calculations. Let them undertake a business-like approach in concert with the industry and that is the way a matter of this sort should be resolved. The Government should, therefore, decide as to whether it is going to be honest and honour the pledges given to the industry or otherwise. That is fundamentally its choice and there is no other.

" ' An Englishman's word is his bond,' so goes the saying, and again the quotation, ' If it be a sin to covet honour, then I am the most offending soul alive.'

" I suggest therefore that there should be a re-examination of the statements made by Lord Morrison as well as those of Lord Woolton and I suggest that there is a review of the discussions in the Commons and the information given by Mr. Heathcoat Amory and Dr. Charles Hill are carefully noted. In addition, I suggest that all documents are re-examined and not confined to the reading of well-drawn briefs which might not give full merit to the correspondence as warranted by this serious state of affairs.

" I am very sorry indeed, at a luncheon like this, that I have to speak on this matter, but I would fail in my responsibility to this Federation if I did not say categorically that we do not agree, for one moment, with the Government's attitude in regard to its pledges, and I wish to make that point clear.

Present Discussions

" We are, at the present time, having discussions with the powers-that-be, in connexion with this matter, and I would ask that the executive becomes more aware of the issues involved and it is up to them to co-operate with the industry and make problems more easily reconcilable.

" After all, a healthy cold storage industry is directly associated with the standards and well-being of the country and its food problems ; particularly is this so, as the industry is vital during times of stress and emergency.

" I hope, then, that the Government will rethink and realise that the importance of this industry is a national asset."

The firm of **Chr. Salvesen & Co.**, whose business was established under the name of Salvesen & Turnbull in 1846 and has continued under the name of Chr. Salvesen & Co. since 1872, will be dissolved as at December 31, 1960. The business will continue under the name of Chr. Salvesen & Co. Ltd., a private company recently formed by the partners with a view to bringing their organ-

zation into line with the needs of the times. The new company will formally take over as from January 1, 1961, with Mr. L. M. Harper Gow as chairman and managing director and Messrs. H. W. Hollyer and G. H. Elliot as assistant managing directors. No significant change in personnel is involved with the exception that Capt. H. K. Salvesen withdraws from direct managerial responsibility, while remaining chairman of the boards of the family group of shipowning companies now to be managed by Chr. Salvesen & Co. Ltd.

* * *

Cold caulking compounds PC3 and PC4 are described in a well-produced brochure recently issued by **Expandite Ltd.**, Chase Road, London, N.W.10. These compounds, which consist of asbestos and cementatious materials are specially produced for jointing all types of spigot and socket pipes, the caulking of grooves in cast iron and concrete tunnel segments and for the fixing of balustrades hand rails and sheet piling. These materials are easy to use, the makers claim.

* * *

A new arc-welding electrode, know as "Opal 3½ Ni," has been developed by **Cooper & Turner Ltd.**, of Vulcan Works, Vulcan Road, Sheffield, 9, for the welding of low carbon 3½ per cent. nickel and similar steels where good charpy impact values are required at sub-zero temperatures. The new electrode is designated E616 on the BS.1719 coding or E8016—C2 on the AWS—ASTM scale. The basic coating employed gives a clean weld metal, free from minute inclusions of slag and gases, in conjunction with easy, fast deposition characteristics in all welding positions. Particular features are the stability of the arc and the ease of slag control which enable DC and AC supplies down to 70 volts open circuit to be used. The mechanical properties of the "Opal 3½ Ni" electrode include a charpy impact value of 15 to 20 ft. per lb. at—100° C., a yield point at 27 to 31 tons per sq. in., and an ultimate tensile strength 34 to 40 tons per sq. in. The carbon content is 0·5 to 0·8 per cent., with silicon being 0·25 to 0·50 per cent. The manganese content lies between 0·4 to 0·8 per cent. and both sulphur and phosphorous are below 0·03 per cent. each. The nickel content is in the range 3·25 to 3·75 per cent. The electrode is produced in a range of five sizes from 12 gauge to 4 gauge. The current values range from 90 amps. average and 110 amps. maximum at 12 gauge to 260 amps. average and 320 maximum at four gauge, the deposition time per foot of electrode at maximum current being 51 secs. at 12 gauge and 62 secs. at four gauge. The weight of metal deposited per cwt. of electrode rises from 64 lb. at 12 gauge to 78 lb. at four gauge whilst the weight of electrodes required to deposit 100 ft. of fillet weld in the downhand position is 7·5 lb. with a leg length of ¼ in. and 86·5 lb. with a leg length of ½ in.

* * *

A remarkable new protective refrigeration suit has been introduced by **J.C.P. (Industrial Clothing) Ltd.** of Amersham. It has been designed to provide the maximum of protection with the greatest comfort to the wearer. The suit is a one-piece with a full-length zip and elasticated sleeves and ankles (or with adjustable straps) for complete ease of movement ; its lightness is an added advantage where quick movement is required. The outer suit is a two-piece garment weighing only four ounces. It consists of trousers and hooded jacket, fitted with a draw-pull ; it is made from treated Polythelene and is well ventilated. In spite of this lightness the suit provides complete insulation. The new Tropal thermal insulant is employed in the lining (this is a patented process from selected kapok fibres) and the suit therefore has remarkable insulation properties making it 100 per cent. effective in temperatures well below the 40° centigrade that normally obtains in a cold store. The suit is also air blast proof, so that the body temperature is maintained under all conditions. Leather fur-lined calf length boots with rubber non-slip soles complete the ensemble.

* * *

Galvalloy, a new anti-corrosive liquid metal alloy which can be applied either by brush or spray, is helping curb the reign of rust which yearly costs industry in Britain more than £600,000,000. It is a compound of anodic metal particles—99 per cent. pure metal—suspended in a plastic anti-corrosion medium. By making use of a natural phenomena the metals separate upon application into two distinct parallel layers of high purity metal. The two layers have different electro-potentials. The lower, darker layer, is the functional galvanic coating which protects the ferrous surface from rust. The top layer is a light metallic weather foil which protects the functional coating from oxidation by weather exposure. Together they exert a unique double cathodic protection. Galvalloy is claimed to be the greatest advance in ferrous metal protection since galvanizing. It has all the benefits of conventional galvanizing at less than a third of the price and inhibits rust for as long as hot dip galvanizing. Galvalloy is completely incombustible and will withstand red heat. Minor cuts or scratches are self-healing and rust cannot creep under the coating. Galvalloy has been used to protect structural steelwork in pits, wire baskets, metal chimneys (where corrosion losses are always a major factor), hospital equipment, water tanks, the motor industry, refrigeration and air-conditioning plant and superstructures of ships. Galvalloy is manufactured in Glasgow and supplied by Stewart Wales, Somerville Ltd., plastics technologists, Calderbank House, 99 Brownside Road, Cambuslang, Glasgow.

* * *

A new system which is said to provide good protection against corrosion has been developed by **Secomastic Limited,** Bracknell, Berkshire. Known as the Galvafroid-Micanox system of double defence against corrosion, it has been adopted for the protection of some of the largest sea-going vessels now under construction and for protecting steelwork subject to aggressive industrial atmospheres. Various grades have been developed of both Galvafroid zinc rich primer and Micanox micaceous iron ore paint to achieve optimum protection for bridges, chemical works, power stations and for every type of environment.

* * *

The Reddish Chemical Co. Ltd., Cheadle Hulme, Cheshire, suppliers of detergents and sterilizers to the dairy, food, brewing, agricultural and other industries, have appointed **Mr. Frank Ashworth,** A.R.I.C., works manager. Mr. Ashworth was previously production manager of Wm. Blythe & Co., heavy chemical manufacturers, of Church, Nr. Accrington. He is 39 and is married, with four children.

* * *

Mr. C. A. Ganderton, manager of the marketing department of A.E.I.-Hotpoint Ltd., has been appointed to the board as marketing director. Mr. Ganderton, who graduated in history at Southampton University, joined the company in August, 1956, as an assistant marketing manager. He became manager of the marketing department in June this year.

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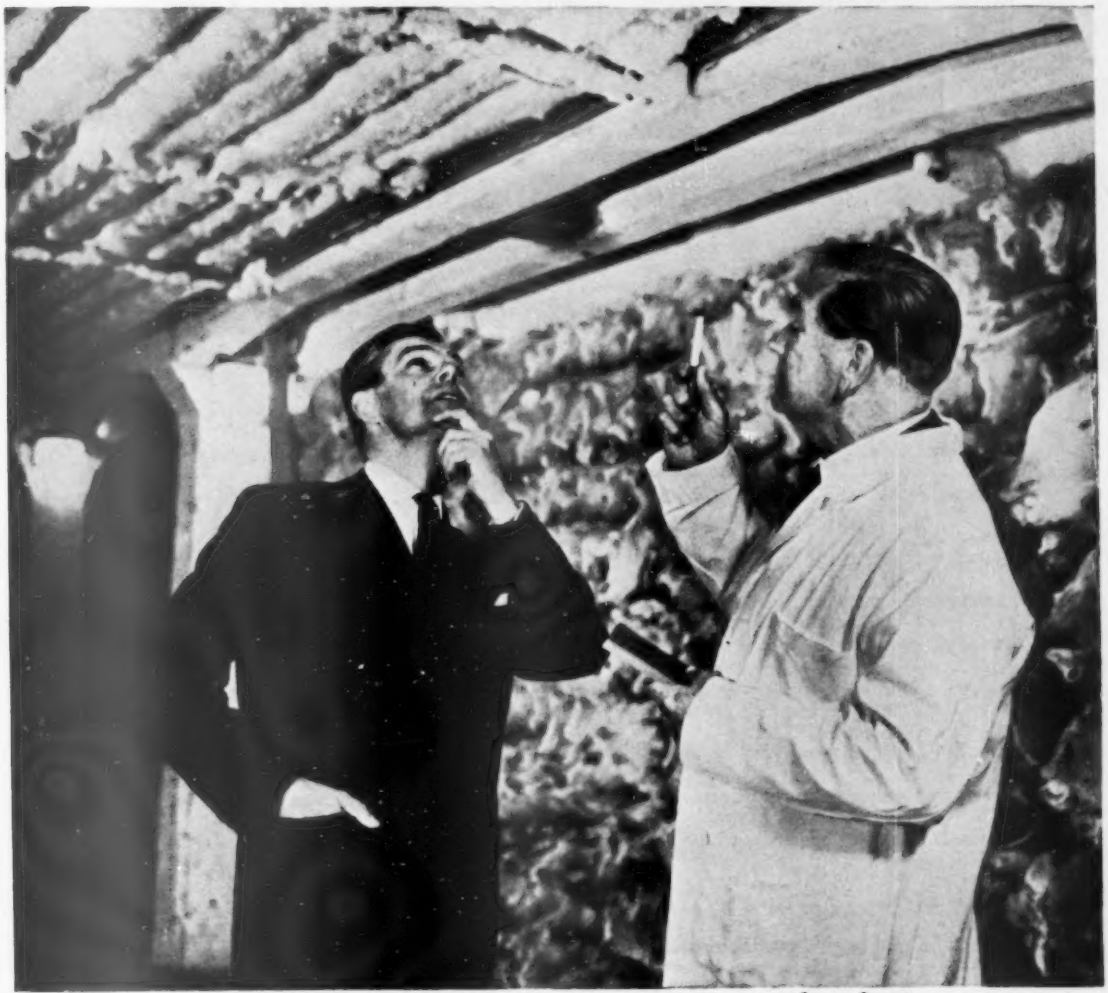

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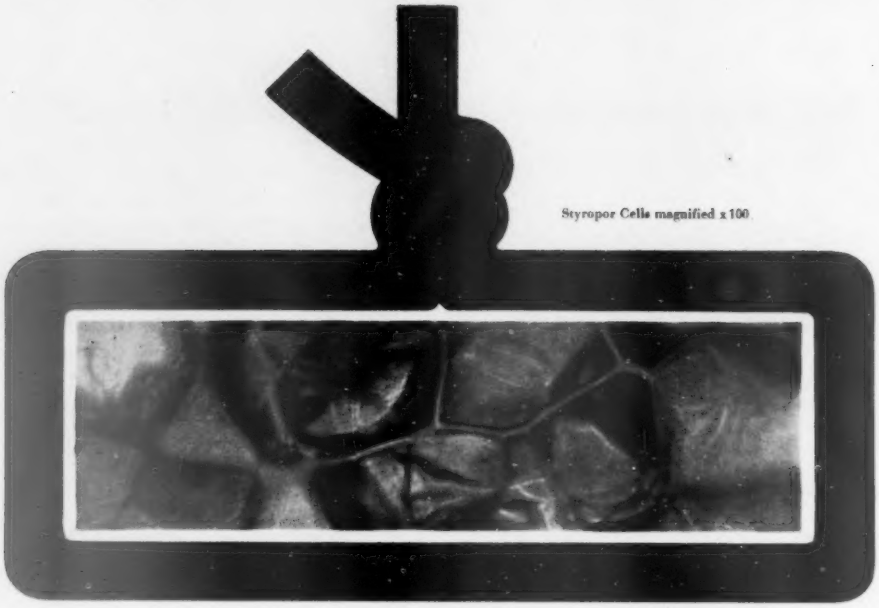

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THE MARSEILLES MEETINGS

Further Extracts from the Papers of the Commissions

(Continued from the October Issue)

COMMISSION III

Experimental Investigation of Ammonia Vapour-Jet Devices Operating as Booster-Compressors.

R. L. DANILOV
Scientific Research Institute of the Refrigerating Industry of the U.S.S.R.
and
L. P. SISOYEV,
Leningrad Dock Cold Store No. 1 (U.S.S.R.)

Vapour-jet devices, used in the capacity of machineless ammonia booster-compressors, are of great interest for the refrigerating industry. Tests carried out at experimental stands and under field conditions in 1957–1959 made it possible to determine the operating peculiarities of the vapour-jet devices as well as to draw generalized characteristics for designing them for various compressor duties in cold stores. The main value characterizing the vapour-jet device operation, is the coefficient of injection, *i.e.* the amount of ejected vapour taken in by 1 kg. of working vapour. According to the theory of vapour-jet apparatus the formula used for the determination of the coefficient of injection, is recorded as follows:

$$u = a\sqrt{\frac{\Delta i_1}{\Delta i_2} - 1}$$

where: u kg./kg.—coefficient of injection ;

Δi_1 kcal./kg.—adiabatic drop of working vapour ;

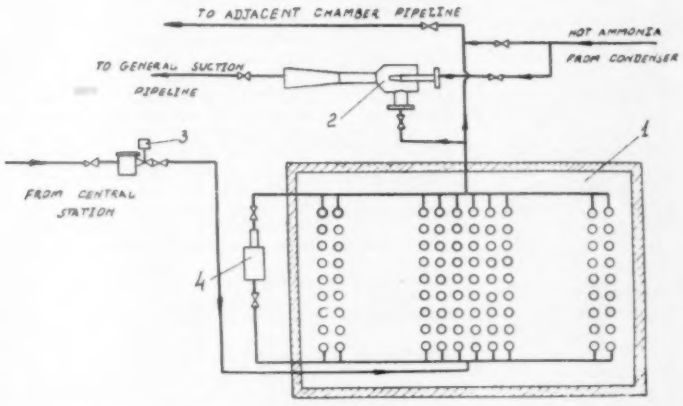
Δi_2 kcal./kg.—adiabatic drop of ejected vapour ;

a —coefficient characterizing losses of high-speed flow pressures in the nozzle, mixing chamber and vapour-jet device diffusor. The coefficient of injection can be determined also from the vapour-jet device heat balance (2)

$$u = \frac{i_w - i_m}{i_m - i_e} \qquad (2)$$

where: i_w kcal./kg.—working vapour enthalpy ;

i_m kcal./kg.—compressed vapour enthalpy ;



Ejector layout.

1. Model SA-1 quick-freezer. 2. Ammonia ejector. 3. Electromagnetic valve. 4. Remote level indicator.

i_e kcal./kg.—ejected vapour enthalpy. Knowing the pressure and temperature of the working, compressed and ejected ammonia vapour, it is possible to determine the respective enthalpy and then determine the vapour-jet device injection coefficient according to formula (2). Coefficient (a) is determined in accordance with formula (1). The vapour-jet device is mounted on the suction line of the quick-freezer (see illustration). Hot ammonia, taken after the oil separator and supplied to the apparatus for warming the coils and removing the frost, is used in the capacity of working vapour. Compressed vapour after the vapour-jet device is supplied to the central suction line of the cold store. The utilization of the vapour-jet device in the capacity of a booster-compressor allowed to lower the evaporating temperature in the apparatus down to –34° C., –38° C. at a general evaporating temperature in the cold store of –24° C., –26° C. and working vapour pressure of 10.0 ata, the air temperature being maintained at –29° C., –33° C.

Investigation of Semi-Conductor Water Coolers.

By V. S. MARTYNOVSKY
and V. A. NAER,
Odessa Technological Institute of the Food and Refrigerating Industry Odessa, U.S.S.R.

The use of semi-conductors for cooling and heating may essentially raise the effectiveness of the plant as

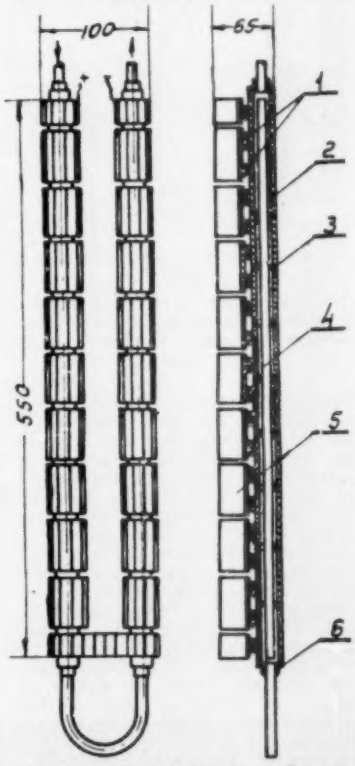


Fig. 1.—Semi-conductor water cooler. 1—thermoelements; 2—pipe section; 3—electro-insulation; 4—displacing element; 5—edges; 6—plug.

compared with the compression one operating at constant temperatures. Meanwhile, according to some researchers, semi-conductor refrigerating plants show lower energy data as compared with compression plants (1, 2). If we assume that the heat capacity of the cooled or heated substances remain constant, then the theoretical effectiveness of large compression and semiconductor refrigerating machines will be equivalent at values Z approx. $\frac{I}{6 \text{ to } 8/.10^{-3}}$ °K, and for plants of low efficiency at Z = 2·5 to $3/.10^{-3}$ $\frac{I}{°K}$.

The utilization of various commutation circuits of thermoelements is possible in order to provide a variable temperature of the semi-conductor thermobattery surface. It is necessary to change the intensity of the current flowing through the thermocouples in order to change the temperature

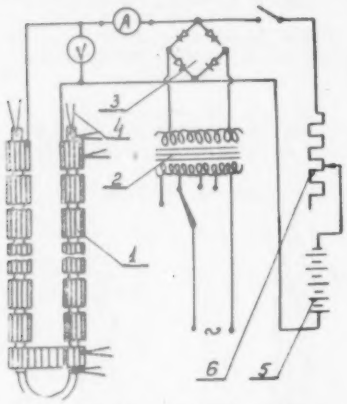


Fig. 2.—Diagram of electrical measurements.

1—water cooler; 2—transformer; 3—rectifier; 4—measuring thermocouples; 5—storage battery; 6—control resistance.

difference at similar geometrical dimensions of the thermoelements in the thermobattery. It can be achieved by independent current supply of separate thermoelements (or groups of thermoelements), or by supplying the entire thermobattery from one power source. A large number of power sources is required in the former case that highly complicates the plant. In the latter case the thermobattery is divided into groups of thermoelements with a various number of thermocouples. The groups are connected in parallel to the power source. The thermoelements are connected inside the groups in series. We obtain a growth of the current intensity in the groups and an increase of the temperature difference between the junctions by reducing the electric resistance of the groups along the thermobattery. The thermobattery can be assembled of thermoelements with variable geometrical dimensions. All the thermoelements are connected in this case in series and supplied from one power source. It is necessary to change the geometrical dimensions of the thermoelements so that they should operate under extremum duties being at various temperatures. A semiconductor water cooler was used for cooling water in order to check the abovementioned experimentally. The design of the experimental semiconductor water cooler is given in fig. 1. The water cooler consists of two sections, each being a pipe with a flat platform 550 mm. long, 16 × 10 mm. dia. and cut into 10 elements. Two semi-conductors : a positive one and a negative are welded to the flat platform of each pipe section. There are 10 thermocouples in each section. The dimensions of the thermoelements of the first section are as follows : 12 × 10 × 5 mm., and of the second section 10 × 8 × 5 mm. All the thermoelements are connected in series. Commutation is performed by the edges on the hot junctions and pipe elements on the cold edges (fig. 1). Electroinsulating gaskets are set between the pipe elements. A displacing element is inserted into the pipe to accelerate the velocity of the cooling water flow. Heat transfer takes place on the hot junctions from the edges to the motionless water.

[1] M. BÄCKSTRÖM, (1959). " The Peltier effect contra the conventional refrigerating processes." 10th International Congress of Refrigeration, Copenhagen.

[2] V. S. MARTYNOVSKY, V. A. NAER. (1959). " On the energy efficiency of thermoelectrical refrigeration." 10th International Congress of Refrigeration, Copenhagen.

Thermodynamic Properties and Thermal Diagrams of the Binary System Lithium Bromide Water.

By H. LÖWER,
Technische Hochschule, Karlsruhe, German Federal Republic.

Heat diagrams were shown which are an invaluable aid to engineers who have to deal with absorption machines, facilitating their calculations. Likewise, the important physical properties of LiBr solution such as viscosity, density, surface tension and heat transfer coefficient are dealt with in the paper in question. In the realm of air-conditioning technology the removal of heat quantities by refrigeration plants has to be actuated in the limited evaporation temperature range between 0° C. and + 10° C. Machines built on fundamental scientific principles such as compression, absorption, radiation are equally feasible ; however, importance must be attached to : (1) economical, automatic, silent and vibrationless operation ; (2) use of odourless and non-toxic refrigerant. The absorption machine fulfils the first condition extremely well whereas in using water as cooling agent and an aqueous salt solution as absorbent complies fully with the second. Besides the since long known absorbent media for water such as sulphuric acid, sodium hydroxide, potassium hydroxide and salt solutions, it has come of late that lithium salt solutions have been recognized as an excellent absorption medium for steam. The outstanding advantages are high absorption capacity, relatively low crystallisation temperature, and low viscosity in solution. The latter confers fluidity and high heat transfer coefficient in machines. Of the above mentioned lithium salt solutions, the one with lithium bromide has attained high importance. In designing refrigeration plants knowledge of the thermodynamic properties of intended binary systems is a prerequisite. The binary system $LiBr/H_2O$ forms the subject of study in the sequence : the construction of diagrams for vapour pressure, enthalpy/concentration and entropy/concentration.

The Liquefaction of Methane—Comparison of a Few Cycles at 113° K.

By M. BEDUE
Chantiers de l'Atlantique (France)

After a brief review of the main cycles for methane liquefaction, the communication describes in detail cascade cycles such as : Ammonia, ethylene, methane or propane, ethane, methane. It is shown that the power required for the liquefaction of methane can be separated into two parts : one for the refrigeration plant, the other for the liquefaction plant itself ; the total power required varies very little with the ratio of the two. It is therefore worthwhile to increase the refrigeration part which involves normal refrigerating machinery ; however, enough power must still be available at the liquefaction plant to operate above the critical point of methane. The use of the notion of total refrigerating effect of the cycle in relation to the temperatures involved is very useful in designing the heat exchangers and the operating pressures.

Lithium Bromide Water Cooling Systems for Air Conditioning

By J. R. CHAMBERLAIN,
Borg-Warner Corporation, York, Pa. (U.S.A.)

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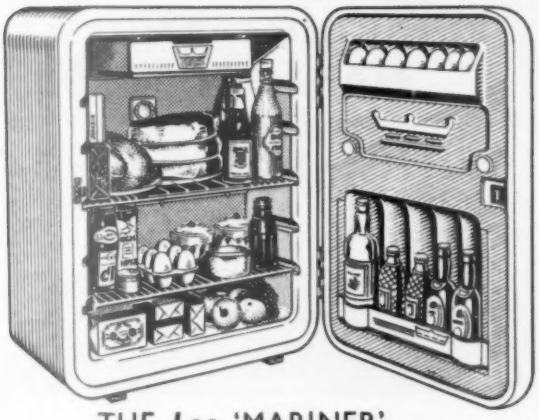

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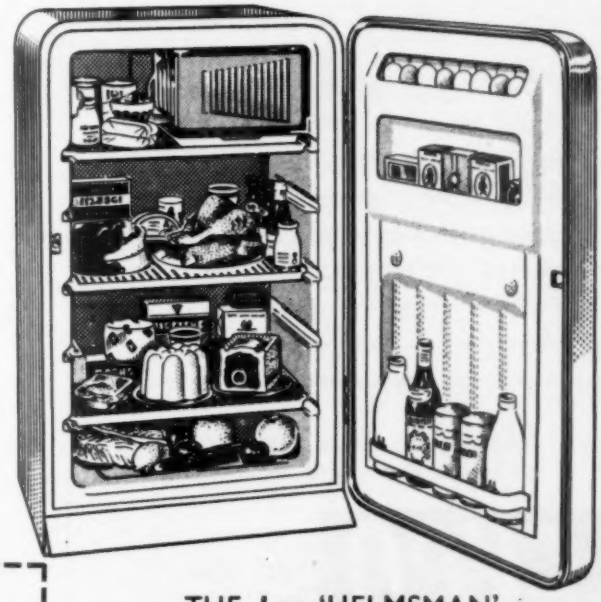

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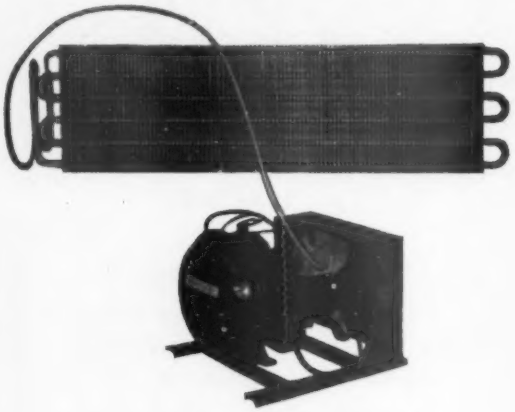

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which for their protection has resulted in a relatively high " demand " charge. To create a corresponding winter electric load, electrical power utilities have pushed the heat pump for year-round heating and cooling using electricity as the energy source. In contrast, there is a similar argument for the use of heat powered year-round heating and cooling. Heating with fossil fuels in the winter means that unless heat powered air-conditioning equipment is used in the summer, boiler plant equipment is idle six months of the year or more. Gas utility companies found the problem extremely critical since without a counterbalancing load for the summer months, they may operate at reduced revenue for six months of the year. It becomes most natural, therefore, where fossil fuels are used as the heating means to consider heat source air-conditioning for the summer. This paper is limited to larger cooling installations, say, above 100 tons refrigeration (302,000 kcal./*h*). Office buildings, manufacturing plants, airport terminals, hospitals, banks, and hotels are typical of the kinds of establishment which find it economical to operate boiler plant equipment throughout the year—in winter for heating, and in summer for heat powered air-conditioning. This avoids the need for summer shutdown of boilers, reduces maintenance costs of the boiler, and adds to boiler life. Steam is available for reheat, cooking, and water heating. Economic studies often indicate substantial savings in first costs involving reduction in size of electrical service, entrance, transformers, power control centres and wiring : Lower energy costs per unit of refrigeration often result, involving reduction of electrical demand charges and by reason of attractive gas rates made available by the gas companies. A further advantage : Heat powered equipment with no moving parts, aside from relatively small pumps, simplifies the matter of floor loadings ; such equipment is practically vibrationless.

Experimental Investigation of " FREON " EJECTORS

By S. Z. ZHADAN

Odessa Technological Institute of the Food and Refrigerating Industry Odessa, U.S.S.R.

As is generally known, steam-water ejector machines have a number of drawbacks due to the specific properties of the working substance (water) used in them : (1) presence of vacuum in the evaporator and condenser, the maintenance of which requires additional power and auxiliary devices ; (2) large dimensions of the spraying apparatus ; (3) low values of the cycle thermodynamic data. The idea of using low boiling substances in ejector refrigerating machines has already long been proposed by Guarini and was further developed in the theoretical investigations of Kazavchinsky and Kalustyah. An ejector unit using $C_2F_3Cl_3$ was built in the U.S.A. in 1937. It was not tested thoroughly. The power data received proved to be quite low (1). Difluorodichloromethane CF_2CL_2 is a harmless agent providing the absence of vacuum in the system and comparatively low pressure of the working vapour before the nozzle. Ejectors, working with this refrigerant, have been tested in the laboratory of refrigerating machines of the Odessa Technological Institute of the Food and Refrigerating Industry. The diagram of the test stand in its last version is given in fig. 1. The required pressure of the working vapour before the nozzle of ejector 1 is maintained by means of the service compressor 2. The buffer vessel 10, located between the compressor and the ejector, is designed to reduce pressure pulsation and oil separation. The latter may be discharged into the crankcase through the return line 7. The working vapour, expanded in the nozzle, carries away the low pressure vapour coming in from vessel 11. The formed mixture is compressed in the diffuser to some intermediate pressure and then supplied to the stabilizing section of the straight pipe and flows successively through two diaphragms 4 equipped with differential manometers 5. A pipe tap to vessel 11 is located between the first and second diaphragms. The expansion valve 6, mounted on this line, allows to reduce the pressure of the suction vapour to the required level. The vapour flowing through the second diaphragm, is directed to the heat exchanger 3 where it transfers to the cooling water heat equivalent to the work of the compressor (for the exception of losses to the surrounding medium). The cooled vapour is sucked in by the compressor. The coefficient of ejection was measured by means of the two mentioned similar diaphragms.

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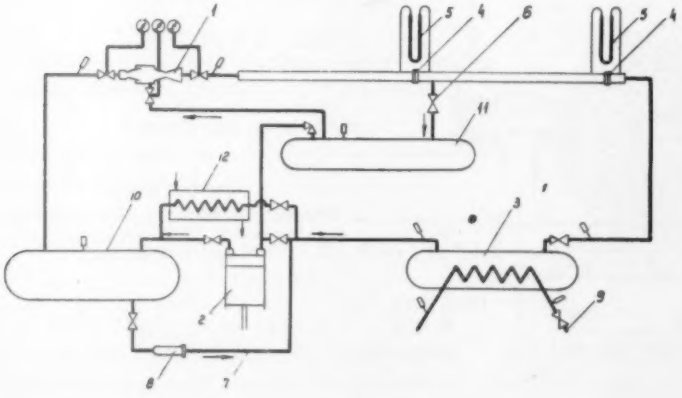

Diagram of experimental stand. 1—ejector; 2—2FV-6.5 compressor; 3—heat exchanger; 4—normal diaphragm; 5—differential manometer; 6—expansion valve; 7—oil return line; 8—filters; 9—cooling water feed; 10—liquid receiver; 11—Evaporator vessel; 12—heat exchanger on the by-pass line.

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The use of a vapour jet ejector in low pressure stage of refrigeration cycle using condensable vapours.

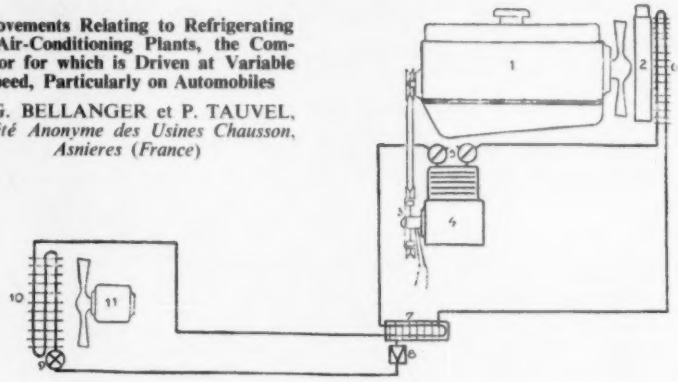
By P. GIRARDIN,
Etablissements Brissonneau and Lotz, Nantes (France)

The use of a vapour jet ejector in the low pressure stage has been presented in a report by Prof. Badylkes to the I.I.R. meeting in Moscow, 1958.

It is interesting to study the operating characteristics using various refrigerants and assuming different ejector efficiencies. The curves give, for different suction pressures at the high stage, the ratio between the cooling capacity available at the low stage and the capacity of the high stage operating without ejector. These curves throw light upon the possibilities of the device.

Improvements Relating to Refrigerating and Air-Conditioning Plants, the Compressor for which is Driven at Variable Speed, Particularly on Automobiles

By G. BELLANGER et P. TAUVEL,
Société Anonyme des Usines Chausson, Asnieres (France)



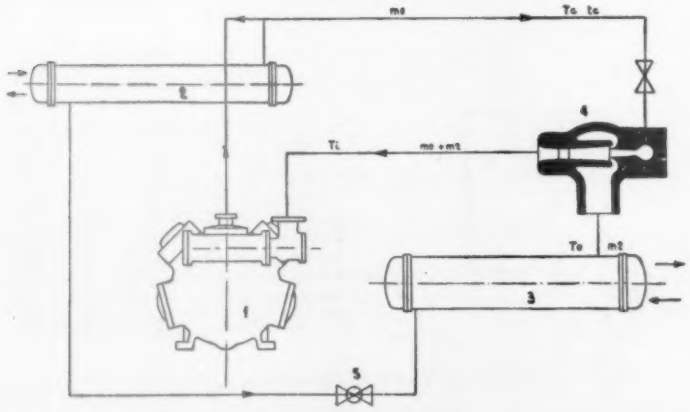
1—Auto engine; 2—radiator; 3—magnetic clutch; 4—compressor; 5—compressor valves; 6—condenser; 7—Heat exchanger; 8—drier; 9—pressure valve; 10—evaporator 11—evaporator fan.

The object of the device which is described is to improve the working of those refrigerating plants in which some of the components are subject to important variations, so that the parts of the circuit are no longer in balance, *e.g.*, very variable refrigerating capacity and heat transfer. This problem corresponds particularly to the air-conditioning of automobiles in which the compressor is driven at a revolutionary speed proportional to the speed of the engine, thus producing a refrigerating capacity which can vary widely. As the need for refrigeration is greater at low speeds, there results at high speeds, an excess capacity, an excessive consumption of power and an exaggerated size of the exchangers to cope with working at maximum speed. The device is based on the use of a heat exchanger connected in series with the main evaporator ; this provides heat transfer with the condenser.

Investigation of the Influence of Refrigerant Charge on the Heat Transfer of an Ammonia Shell-and-Tube Evaporator.

By V. B. YAKOBSON,
Scientific Research Institute of the Refrigerating Industry, Moscow, U.S.S.R.

A change in the charge of the evaporator with refrigerant influences considerably the operation of the refrigerating machine : if there is insufficient liquid in the evaporator, the machine performance factor drops ; if there is excessive liquid, the compressor operates with wet compression



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and a hydraulic impact is possible. Level and superheat controls are used for automatic regulation of evaporator filling. To shift the regulator valve from a fully open position to a closed one, a certain change of the controlled value (level or superheat), termed control offset, is required. The control offset should be such that at a change of the heat load from zero to the maximum the evaporator heat transfer coefficient should not be below the given limit and the wet compression should be completely eliminated. At the given heat load Q, the reduction of the heat transfer coefficient k (referred to the entire evaporator outside surface) should be compensated by a corresponding increase in the temperature difference θ between the refrigerant and brine

$$Q = kF\theta = (k - \Delta k)\,F\,(\theta + \Delta\theta) \quad (1)$$

It is necessary to reduce for this purpose the evaporation temperature at a given brine temperature. This causes a reduction of the machine performance factor K kcal./k W-hr.

The author determines the limits of permissible change of the heat transfer coefficient in the example of an ammonia shell-and-tube evaporator.

Refrigerating Absorption Machines with Additional Saturation of the Strong Solution

By B. M. BLIER,
Astrakhan Technical Institute of the Fisheries, Astrakhan, U.S.S.R.

The process of absorption is usually considered as a process reversed to generation. However, the processes taking place in the generators have different temperature characteristics at the heat supply while the absorption process has only one. An absorption machine cycle running within the concentration limits of $\xi'_r - \xi_a$ is shown in fig. 1. Let us analyse in this cycle two processes of generation. I-a process taking place in the generator and combined with the rectification process in which the heat is supplied within the whole range. Vapour concentration ξ'_d close to equilibrium with the strong solution is reached in this process without additional rectification. Process II, carried out in the generator has incomplete combination of evaporation with the process of rectification due to which the evaporation is performed only on the section 2A, while the process on the section AB′ is performed in a complete rectifying column due to which the vapour receives the same concentration ξ'_d as of the leaving vapour. Though the heat consumption in both processes is the same, the first is thermodynamically more advantageous because the heat supply is performed in the range from t'_B to t_2, *i.e.* at lower temperatures than in process II where the heat supply is carried out in the range of higher temperatures $t_A - t_2$. The absorption process

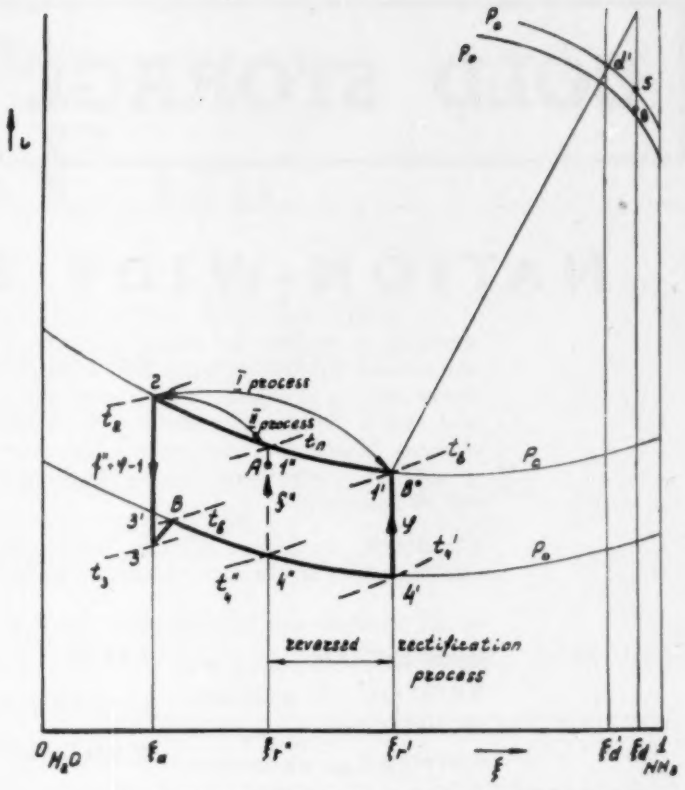
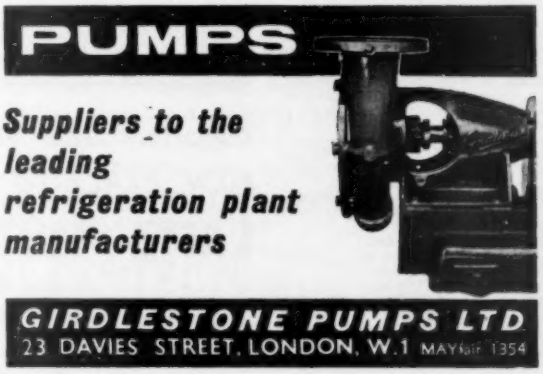


Fig. 1—Processes of generation and absorption in the diagram.

applied in absorption machines is a reversed process of generation type I. Hence, the heat of absorption is removed in the entire range of concentrations due to which the highest concentration of the solution is determined here by the pressure of absorption and the lowest possible temperature of the strong solution t'_4. A reverse of the generation process type II should lead to a tap of the absorption heat in the range of higher temperatures that makes it possible to provide saturation of the strong solution to a concentration higher than stipulated by the pressure and lowest temperature of solution cooling. This type of increasing the concentration should lead, in its turn, to an improvement of heat characteristics of the absorption machine cycle.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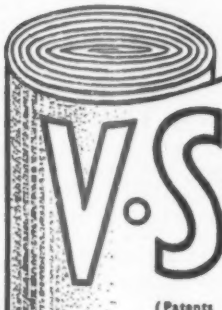

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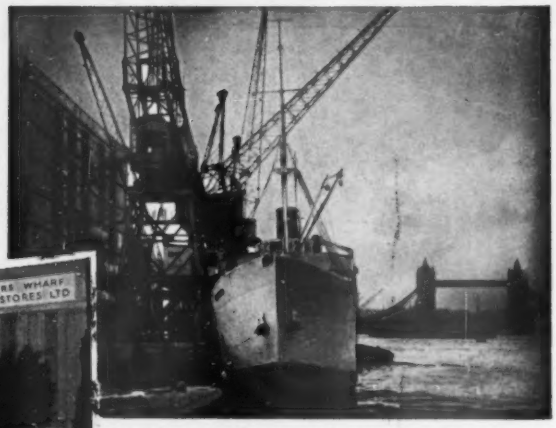

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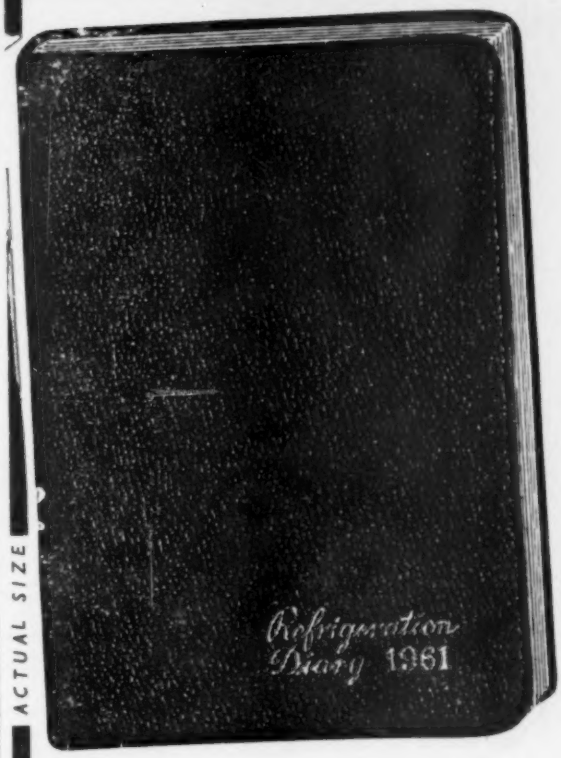

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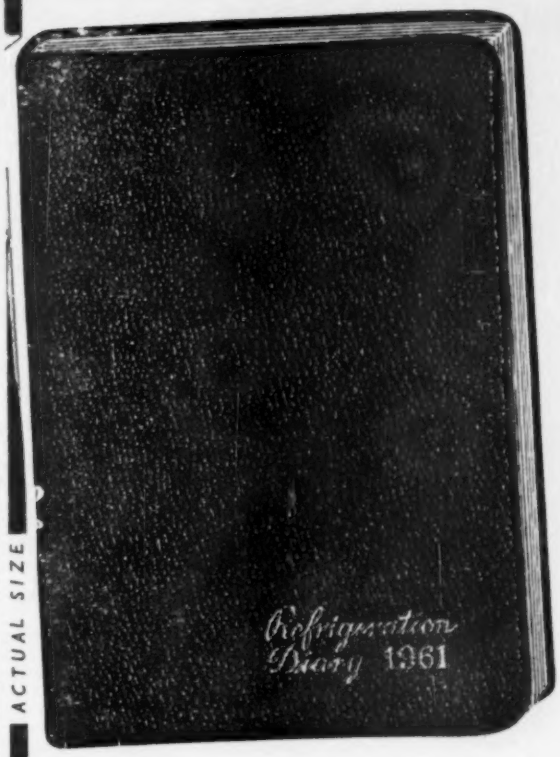

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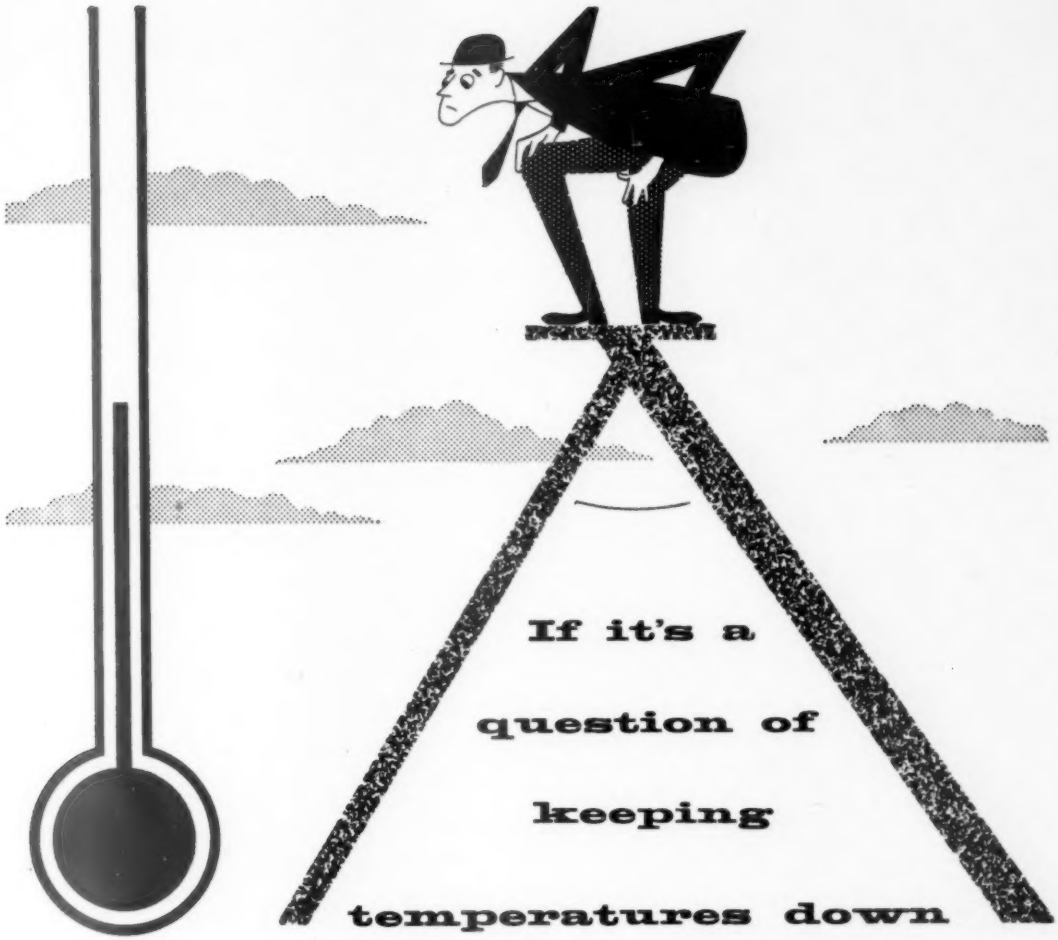

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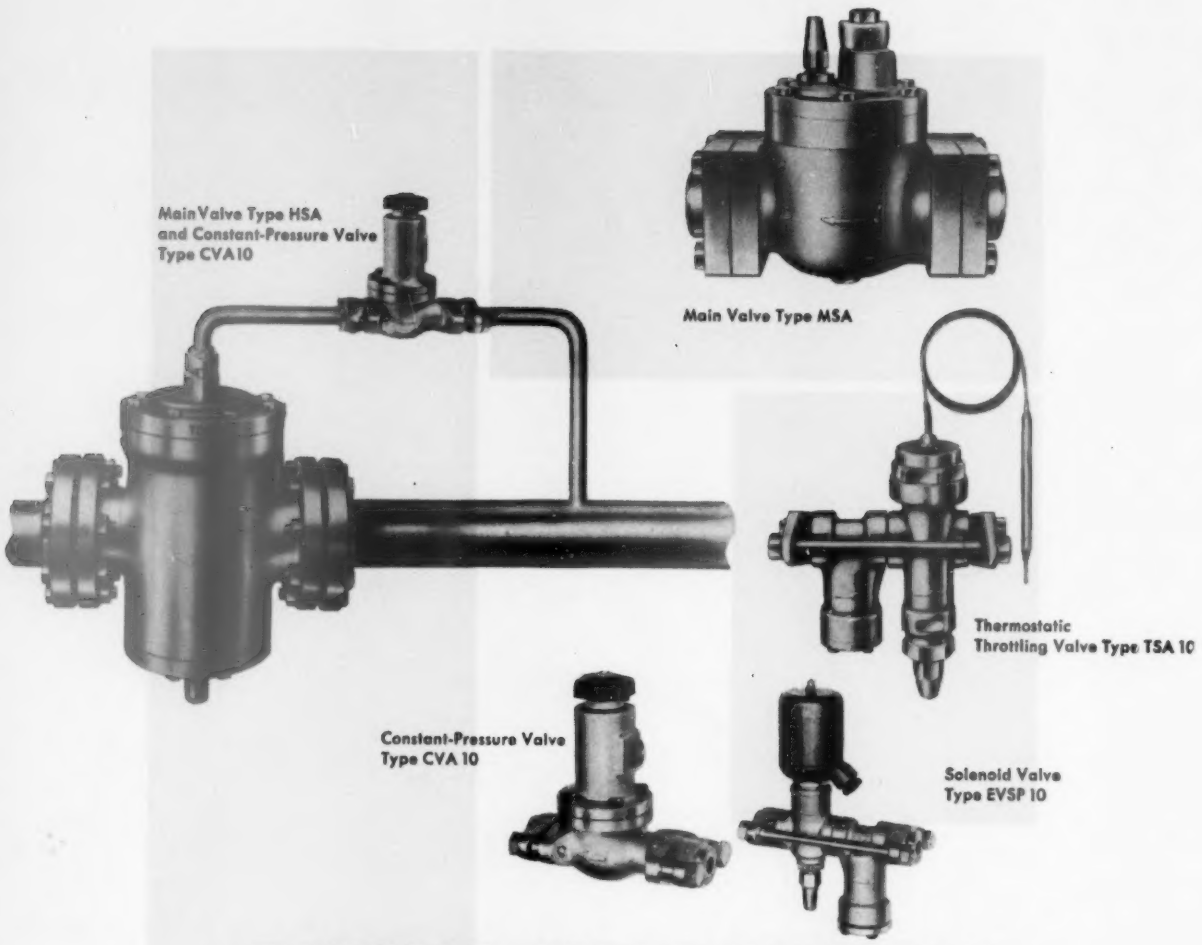

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